PROCEEDINGS AND PAPERS

OF THE

Twenty-seventh Annual Conference of the

California Mosquito Control Association, Inc.

AT

MARK THOMAS' INN

MONTEREY, CALIFORNIA

FEBRUARY 2, 3 AND 4, 1959

Edited by

C. DONALD GRANT

PUBLICATIONS COMMITTEE

G. EDWIN WASHBURN | JOHN R. WALKER | C. DONALD GRANT, *Chm.*

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CALIFORNIA MOSQUITO CONTROL ASSOCIATION

FIRST SESSION

MONDAY, FEBRUARY 2, 1959, 9:00 A.M.

CALL TO ORDER

ROBERT F. PORTMAN, *President*

Ladies and gentlemen, it is indeed a pleasure and a privilege to welcome you to this Twenty-seventh Annual Conference of the California Mosquito Control Association—the outstanding organization of its kind in the world—in such pleasant surroundings as are afforded by the Monterey Peninsula, a world renowned garden place of scenic beauty and climate.

The facilities and activities which have been arranged for us during our attendance at this Conference by Howard Greenfield, Manager of the Northern Salinas Valley Mosquito Abatement District and Chairman of the Conference Arrangements Committee, as well as by members of his Committee and the Board of Trustees of his District, promise to make our stay in Monterey most enjoyable.

Those who have not registered as yet may do so at the registration desk in the lobby. May I urge you to obtain your reservations for the banquet from the registration clerk at your earliest convenience. The fellowship to be experienced during the hospitality hour, which precedes the banquet, is a highlight to be long remembered.

And now, I would like to call on Mr. Chester Deaver, Chairman of the Board of Supervisors of Monterey County.

Supervisor Deaver: Thank you, Mr. Portman, ladies and gentlemen. As the Chairman of the Board of Supervisors of Monterey County, it is my privilege and indeed my pleasure to welcome you to Monterey County for your Conference.

We in county government especially appreciate the work that your group is doing. We have experienced that in Monterey County our program is going forward and is accomplishing those things which we expected it to do when it was created. We know that you folks—when you are here with your Conference, coming from all parts of the State—with your knowedge and experience will assist us in our program, and we hope that we may make a contribution to your program.

We want you to spend as much time as possible from your agenda, which I know will be full, to travel through our County and experience what we have here to offer you. We know that you will not be able to see all that could be seen, but we hope that you will see enough to induce you to return to our County at some future date and experience what we have here.

We wish you a very interesting and pleasurable stay in Monterey County, and please come back some day soon. Thank you.

Pres. Portman: And now I would like to introduce to you Mr. Dan Searle, Mayor, City of Monterey.

Mayor Searle: It is indeed a pleasure to say "hello" to you this morning.

My experience with mosquitoes happened to be in Italy. I think the only successful invasion that was ever made through southern Italy was by the Armed Forces in World War II. I happened to be attached to the Air Force at the time, and we were lucky; we had quinine that we could take to help battle off the mosquitoes, whereas the foot soldiers had to take stuff by the name of Atabrin. And I want to tell you that it was really rough, that stuff. We couldn't actually take it and then fly right away; we had to wait at least two days after several doses of that Atabrin. And as you all know, like any other effective cure that you have, there isn't any. There is just one way to keep that malaria away; the only thing to do is to kill them.

It is fascinating for me to have the opportunity of seeing you people who chase the mosquitoes, rather than the other way around, they are usually chasing me, I know that. So, it's a cause that you don't get very much thanks for, and you fellows that are scientists and dedicated to this kind of work, certainly deserve a lot of praise; and I want to extend a very warm and cordial welcome to you; and in your meanderings around town, if you get into any trouble, why just mention my name and pay cash. Thanks.

Pres. Portman: That was very good advice.

I would like to introduce Mr. Arthur C. Atteridge, Mayor, City of Salinas.

Mayor Atteridge: Mr. Portman, ladies and gentlemen of the Conference. I am very pleased to join with my colleagues, Mayor Searle and Chairman Chester Deaver, in welcoming you to Monterey County. I am particularly pleased to be here because the representative of Salinas on the North Salinas Valley Mosquito Abatement District, Bud Glikbarg, is also a director in your Association, and we are proud of this accomplishment. The only reservation I have, I don't see him yet this morning, and I'll speak to him on that.

Naturally I do not have a great knowledge of the activities of your Association, except in my particular area to note the results by the absence of disease. As a former possessor of one of the finest Atabrin tans in the Pacific, I note the danger of malaria, and I saw the cases of men who had serious illness in that effect. And I appreciate its absence in my area, which, by the way, is crossed with numerous sloughs of the old days and the slow moving and stagnant water of the dry Salinas River. And I am sure that if we did not have an active District around the Salinas Valley and the Castroville, Moss Landing area, we would have a great deal of illness. I trust that your conference is most successful, and that in view of the fine weather you have a full opportunity to examine the need for mosquito abatement on the local golf courses. Thank you.

Pres. Portman: Apparently our friend, Howard Greenfield, is ill this morning, I haven't seen him. I

know he was feeling badly last evening. So, is Mr. Grib here? I would like to introduce to you Mr. Aaron E. Grib, President, Board of Trustees, Northern Salinas Valley Mosquito Abatement District, who, I understand, was one of the initial members on the Board, and has been on this Board since 1950.

Mr. Grib: Thank you, Mr. Chairman, ladies and gentlemen. After seeing our Mayor from Salinas I just want to assure you that I am not standing in a hole.

Howard didn't tell me that I was going to have all these speakers ahead of me, and I had a big speech all prepared, of welcome and so forth. But it seems that they all stole my stuff and thunder, and all I want to say, instead of a big long speech, is welcome. We hope you all have a good time, do a lot of work—of course I know you all will, these Conferences are composed of work. But then don't forget: all work and no play makes Jack a dull boy. I know the golf courses around here are inviting; if you haven't seen them, it is time you did. And for the ladies, of course Carmel is nearby, hang on to your pockets and pocket books.

But I am sorry to hear that Howard is ill; I was looking for him all morning. So on behalf of the Trustees, the personnel and myself, I wish you welcome, and hope you come back again soon. Thanks.

Pres. Portman: As I call the names of these visitors to our Conference here today, who are from out of State, I wonder if they would just please rise. And if by chance I have overlooked someone, please forgive me, because I made up this list this morning and it may be that somebody registered since then. Richard Gaugin, South Salt Lake, Utah; Jay Graham, Salt Lake City, Utah; Sam Hartman, Salt Lake City; Don Rees. Don, would you come here and say a few words of advertisement for the AMCA meeting.

Don Rees: It is a pleasure to be here this morning, and I didn't expect this opportunity to invite you to attend the meetings, but I welcome it. The meetings of AMCA and the Utah Association will be held in Salt Lake City, as you are do doubt aware, on the 12th to the 15th of April, I think that is the correct date. We are making plans for the program. Archie Hess, President-elect, who is here at this meeting, should be making this announcement. And for an excellent program, the meetings and the headquarters will be held at the Hotel Utah. We have put in an order for excellent weather conditions. We hope you will all be there, and we will try to put on one of the best meetings you have had an opportunity to attend. Thank you.

Pres. Portman: Thank you, Don.

Frank Baer, Henderson City Health Department, Nebraska; Robert Nicols, Las Vegas, Clarke County, Nevada; Glen Collett, Salt Lake City Mosquito Abatement District, Utah; Oscar Lopp, South Cook County Mosquito Abatement District, Illinois; LaRue Jensen, Riverton, Utah, Trustee of the South Salt Lake District; and is Archie Hess in the room this morning? No, he is in the lobby. Do we have any other visitors from out of State? Louie Ogden. Mr. Schoenfeld. Have we more? Maybe we ought to make this like the Rotary Club and fine you if you don't introduce your visitors.

Is Mr. Mansfield here? We are early in our agenda this morning, but at this time I would like to have Mr. Walter S. Mansfield, Chief, Administrative Officer, Monterey County, Salinas, address us on the "Principles and Practices of Public Administration." Mr. Mansfield.

PRINCIPLES AND PRACTICES OF PUBLIC ADMINISTRATION

WALTER S. MANSFIELD

Chief Administrative Officer
Monterey County, Salinas

President, members of the CMCA and guests. I came about a half hour early so I could get woke up here before I started, but it kind of got ahead of me. So, I presume this means then that I am to go to about 11:30, is that correct? I have that long a speech prepared, but, I don't know, I might lose all my audience by then.

The topic that I wish to discuss with you this morning is as listed in the program, and we, in the manager or administator field, have certain ideas as to what are good practices and principles of public administration. It is my understanding that this is the first time this had been discussed with your group, I hope it won't be the last. I use the term manager or administrator interchangeably as we discuss this item, as there is, I think, very little difference in our common usage of this term. The common usage of the term, I believe, is a manager, of course, is by charter or has certain powers on his own. The administrator has only the powers that are given to him or through the governing board. We, in the manager or administrator field, I believe, are to a certain extent in the realm of politics indirectly whether we like to consider it that way or not. And being in this field, I believe it is up to us to develop good sound principles and practices of administration for our units of government and not chaos, as illustrated in the story of the physician, the architect and the politician arguing as to which of their professions was the oldest. The physician said, "Why, mine is the oldest. The Bible says that Eve was made from Adam's rib. That was a surgical operation." The architect said, "The Bible says that the earth was created out of chaos." This time the politician could stand it no longer, and he said, "Who the hell do you think created chaos?"

After discussing with you what I believe are some of the good practices and principles of public administration, I would like to leave some time for questions and discussions, if you have them, as I believe that it is from questions and discussions that we would derive most benefit. Now some of the points, which I believe make up good administration for the administrator to his governing board are:

1. We must always remember that one new board member makes a different board to work with, and in many instances makes for a completely new boss for us in our administrative or managerial job. We must consider this new member as a new boss, and treat him in all respects the same as if we were working for one individual and then change jobs to another individual.

2. We must get to know as much about the new member as possible, and be sure we assist him in any way possible in orientating himself to his new responsibilities and duties. One thing we must be sure of is, the point of being overhelpful, however. If he doesn't want assistance in orienting himself to his new responsibilities and duties, we must wait until he is in a responsive mood for whatever help we may be able to give him on his new job.

3. As administrators or managers we should always take the time and effort to establish a good working relationship with each of our board members. This, I believe, is most important, and it is up to the individual manager or administrator in his own good judgment to decide and establish this good working relationship by whatever means he feels will best accomplish this purpose. Establish a good social relationship with the board members if they are so inclined, as many times as it is possible to do a greater amount in the informal atmosphere. I believe this relationship should be established, however, at community meetings and group social affairs—that any house to house source of relationship should be on a very limited basis. Close friends or close social relationships many times tend to make poor working relationships.

5. One of the most important, if not the most important thing, is for the administrator or manager to have a good sense of timing. That is, to bring matters to the board's attention, if possible when you are reasonably sure that they will receive favorable action. An extremely good idea presented at the wrong time probably will accomplish nothing, and will put two strikes on the administrator or manager in getting the proposal accepted at a later date. A good administrator or manager's job is not done when he has made a decision that an idea or plan is good. He then faces another decision, which in my opinion is just as important as the first, and that is, when to present the idea or plan to a governing board for their approval or disapproval.

6. Be sure that you keep your governing board well informed, that they are the first to hear about your plans or ideas, and that they are not the last to hear about these things.

7. A good administrator or manager must keep both his written and oral reports to the board brief and to the point. Governing boards are not interested in long written or oral reports, and many a good idea or plan has gone down the drain because the explanation was not brief and to the point. If possible never make more than a one page report to a governing body. Governing bodies are not inclined to read more than one page reports. If you find it necessary that your report must be more than one page in length and contains a considerable amount of statistical data, then put your summary and conclusions at the first of your report, hoping that he governing board will at least read the first page.

8. Do everything possible to avoid embarrassing a board member on any item. If a board member gets himself out on a limb, don't just let him hang, help him get off the limb. Possibly in the future he will exercise more caution and will appreciate your help.

9. Be a front man for the board member if necessary. If he has a good idea, but for some reason it would be embarrassing or not good for him to present the proposal, then the administrator, in my opinion, should make the recommendation to the governing board. Let the member who is primarily interested in the idea support the proposal.

10. Conversely, if you have a good idea or proposal which you know some board member is particularly or vitally interested in, give the idea to him and let him bring up the proposal to the governing body. It would be advantageous to him in his position.

11. Always remember the board member needs to run for election or appointment, you only work for them. Remind yourself occasionally that you are the administrator and not the governing board.

12. One of the basic principles of the administrator or manager type of government is that the governing board handles the policy and the administrator or manager handles the administrative matters. Here is where one of the most difficult decisions an administrator has to make enters, and that is—where is the dividing line in the gray zone that separates policy and administration? The handling of this principle properly, in my opinion, probably makes or breaks more administrators or managers than any other single item.

Now some of the fiscal good principles and practices of public administration.

1. The most important thing you have during the year is the preparation of your budget. This is your whole year's work program. Therefore, give a lot of careful thought to your budget. Be sure it is not done in a haphazard manner. To prepare a good budget requires time and thought. However, the time used is probably the best that you spend during the year and the most productive.

2. In submitting your work program to your governing board for the next year, do this by submitting brief narrative reports outlining the more significant plans rather than just a lot of statistics.

3. Remember that a budget is not an authorization to spend. Be sure before you make significant purchases to evaluate the budgeted item. It may be that conditions have changed since it was placed in the budget.

4. When changes have to be made in the budget, question yourself, your foremen or those responsible to you very carefully about the needed change. Many times poor planning will come to light at this time.

5. The good administrator will prepare a good, sound, long-range capital outlay program, so that projects can be properly planned and completed when needed, and not once a year after they are needed with the resulting increased costs in maintenance and constructions. The poor administrator who does not plan his capital improvement is faced with emergency projects which in most cases are extremely costly as well as being very poorly planned.

6. Set up work units for your work program so that you and your department head or division chief are able to make estimates of the amount of work in the department, as well as the increase or decrease in this work. Have the work unit measure a unit which you and your department head agree is a reliable measure of the work in the department. Be sure that you have a good system of recording and reporting these work units in order that they may perform their proper functioning in budgeting.

In conclusion of what I have to say now, I believe that a good administrator should always have the courage to fight for the changes which he believes will be of benefit to the agency which he serves. However, he should always have the patience, and whatever else is necessary, to accept the things that he cannot change.

Now, if you have questions on administration, I will be glad to take some time to answer any questions, and give my opinion on anything that applies to public administration or that field.

Mr. Gray: Mr. Chairman, I would like to have a little clarification on one of the earlier points that was made, when I believe the speaker indicated a rather overemphasis on the individual members of the elected rather than appointive boards. However, it has been my experience for at least a half a century, that one of our great problems between an administrative officer and the governing boards is the problem of how far the individual member of the board should concern himself with purely administrative details. One of the greatest difficulties, I think, that managers or administrators or executives of all kinds have with the members of various boards is that of getting them to act as a unit on all questions of policy and to refrain from having the individual councilman, supervisor, trustee and so forth mess around with administrative details. I think there is a very considerable amount of the art of administration in maintaining good relations between the governing body and the administrator in that particular respect. If the Boards do not act as a unit in the determination of policy, you have internal frictions not only within the board, but between the board and the administrator.

I have, over the years, seen quite a number of situations that have occurred, sometimes through no fault of the administrator, but simply because of personalities within the governing boards. I can assure you that it is a very unfortunate situation when it does occur. You have heard me talk on a number of occasions and at different meetings, both here and at the American Association, on the absolute necessity for the boards acting as a unit and not having divisions with pulling and hauling within the boards and between the boards and their administrator. It requires a certain amount of restraint on the part of the board members at times. Of course, there are bound to be disagreements on occasions, but I think it is very much like one of the stories about the English Cabinet during the administration of Mr. Gladstone, the Prime Minister. They had a very difficult question of public policy that was being discussed in a cabinet meeting. They seemed to be very far apart, but finally Mr. Gladstone rose and said, "Well, gentlemen, we are going to leave this room with a decision of some kind. I hope it will be the truth, but if it's a damn lie, we're all going to tell the same lie."

Mr. Mansfield: I think the item you speak of is one of the problems of any administrator, and that is one of the reasons that I emphasize the relationship between the administrator and the governing board. Now, I think that any administrator has to furnish any member of his governing board, whenever they request it, any information on anything to do with the operation, on past policy—anything up to the point where he wants to establish policy with the administrator. At that point I believe that the administrator or manager has to remind the member of the board that that is a matter of policy that has not been decided by the governing board. And I think that every administrator has to make it clear to each individual member, when that occasion arises, that he can only operate on the policy set by the governing body as a whole. He can not operate on the policy set by any individual member of the governing board. I think he has to do that diplomatically. I think that is one of the tests of the administrator—whether he stays around a long time or a short time depends upon how he handles those difficult decisions, because it is a real art to be able to tell your individual governing board member that you are not able to do what he would like you to do because it is an item of policy, as you see it, and must be decided by the governing body as a whole. However, if you do it diplomatically, probably you will not have any of those occasions arise in the future.

Any other questions? There being none, Mr. Chairman, I wish to thank you very much for this opportunity of appearing before the group.

Pres. Portman: Thank you very much, Mr. Mansfield. We will now have a short ten minute recess and convene here after the recess.

RECESS

Pres. Portman: I regret that it is necessary to inform you that Mr. Greenfield, who is in charge of local arrangements, is not going to be with us. He is in bed with chicken pox, so perhaps any of you that have already had chicken pox might like to go up and see him—he might like some sympathy.

I have imposed upon our friend, Jack Kimball, who is the Manager of the Orange County Mosquito Abatement District, to give his talk this morning. Jack will speak to us on the "Principles of Purchasing and Procurement."

Mr. Kimball: Mr. President, members and guests, I certainly appreciate the opportunity of reversing times from afternoon to morning, because it prevents this duck out deal which I anticipated this afternoon. Now that we've got you in and I have put these figures on the board, and Bob says that we have all morning, you are at my mercy.

PRINCIPLES OF PURCHASING AND PROCUREMENT BY MOSQUITO ABATEMENT DISTRICTS

JACK H. KIMBALL

District Manager, Orange County Mosquito Abatement District

Mosquito Abatement Districts enjoy absolute freedom in the purchase of personal property or services. This freedom from red tape is probably more responsible for the effective and efficient operation of our mosquito abatement districts than many people realize. The privilege of buying on the open market stimulates the District Manager to operate his District as he would his own business. It enables him to modify the equipment, materials and techniques he uses to control mosquitoes as quickly as Mother Nature modifies her "black sheep" and the places where they live. It also enables him to concentrate his time and effort on mosquito control—the purpose for which he was employed by the District Board of Trustees.

We all recognize that this freedom from required

competitive bidding—the standard method of documenting the "lowest purchase price"—induces a definite responsibility on the District Manager to accomplish the "most efficient purchase" as measured in terms of time and effectiveness, as well as price. I know that this responsibility has been carried out in Orange County and I am confident that other members of this Association have done likewise.

The actual purpose of this talk is to present a proposed draft on "Policies and Procedures for the Purchase and Sale of Materials, Supplies, Equipment and Other Personal Property" which will meet the requirements of Article 6 of Chapter 5, Part 1, Division 2, Title 5 of the Government Code of California. Article 6 requires the governing body of all local agencies, such as our mosquito abatement districts, to adopt policies and procedures, including bidding regulations, governing purchases of supplies and equipment. Copies of the policies and procedures adopted shall be made available to the public. Although this requirement was adopted by the State Legislature in 1957, no specific date for compliance was set forth. A copy of Article 6 is presented as Appendix A.

Before attempting to draft the required policies and procedures, an analysis was made of the operational expenditures during the calendar year 1958 by the Orange County Mosquito Abatement District. These expenditures were grouped as presented in Table I.

ANALYSIS OF TOTAL OPERATIONAL EXPENDITURES
Orange County Mosquito Abatement District
Calendar Year 1958

Salaries and Wages	$55,000	73%
Non-competitive Expenditures . .	11,000	15%
Utilities, Telephone and Postage		
Insurance		
Travel by Board of Trustees		
Journals, Books and Conferences		
Employees Retirement		
Professional Services—Auditor		
"Competitive" Expenditures . .	9,000	12%
Materials, Supplies and Equipment		
TOTAL EXPENDITURES	$75,000	100%

It is evident that the expenditures by our District for materials, supplies and equipment is a relatively small portion of our total expenditures. A further analysis of these so-called "Competitive Expenditures" amounting to $9,000 in 1958, shows how this money was spent, and is summarized in Table II.

ANALYSIS OF "COMPETITIVE" EXPENDITURES
Orange County Mosquito Abatement District
Calendar Year 1958

Type of Purchase	*Number of Suppliers*	*Number of Purchases*	*Actual Expenditures*	*%*
Larvicides	4	34	$3,910	43%
Gasoline and Oil	2	14	1,070	12%
Vehicle Parts	5	43	600	7%
Tires	1	14	380	4%
Office Supplies	6	28	400	4%
All Other	44	170	2,640	30%
TOTALS	62	303	$9,000	100%

During the past year, a total of 303 purchases were made from 62 suppliers and approximately 62% of the $9,000.00 expended went to only eleven suppliers furnishing larvicides, gasoline or vehicle parts. It is evident, therefore, that our purchasing procedure should require provisions to insure competitive prices on these few large expenditures without imposing restrictions on the many small expenditures. And, in fact, our existing "un-written" procedures do just that. Larvicides are purchased as needed from month to month on the basis of telephone bids from three suppliers. Gasoline and oil are purchased from the supplier holding the annual contract with the County of Orange. Vehicle parts and tires are purchased from dealers who extend a specific discount from the established price. The miscellaneous items are purchased from conveniently located dealers who will accept charge accounts, and who in most cases will extend the standard 10% discount.

An initial draft of a proposed resolution to comply with Article 6 has been prepared for the consideration of our Board of Trustees, a copy of which is presented by Appendix B. The rules and regulations to be established by this proposed resolution do not change our existing convenient and efficient purchasing procedure, but they do comply with the requirements of Article 6. Although this proposed resolution is an initial draft, it is based on a written legal opinion received from our County Counsel. With the exception of Section II, Bidding Regulations, this proposed resolution follows quite closely to the Short Form Ordinance recommended by Louis J. Kroeger, President, Public Management Research Institute in that Institute's "Public Purchasing Manual" published in February 1958. Section II differs from the Manual by permitting the purchase of any supplies or equipment costing $1,000.00 or less without notice, advertisement or the securing of competitive bids or quotations.

For those Districts who have not as yet complied with Article 6 of the Government Code, I recommend the Public Purchasing Manual as an excellent source of information on the principles and practices of purchasing. In addition to the short and long form ordinances, it presents procedural regulations and specimen forms. The Manual emphasizes that the purchasing program, to be most effective, must include standardization and consolidation before competitive bidding, as well as inspection, testing and prompt payment of bills following receipt of the purchase.

In conclusion, I wish to emphasize that the proposed resolution which I submit is only an initial draft, subject to revision by the Board of Trustees of my District. However, I hope that it may be helpful to some of you, and that next year this Association may be able to recommend a model resolution, plus procedural regulations, that will be a pattern for all Mosquito Abatement Districts in California.

APPENDIX A

An act to add Article 6 to Chapter 5 of Part 1 of Division 2 of Title 5 of the Government Code, relating to purchases of supplies and equipment.

The people of the State of California do enact as follows:

SECTION 1. Article 6 is added to Chapter 5 of Part 1 of Division 2 of Title 5 of the Government Code, to read:

Article 6. Purchases of Supplies and Equipment by Local Agencies

54201. As used in this article, the term "local agency" means every city, county, city and county, district, or any other local government body or corporation empowered to expend public funds for the acquisition of property.

54202. Every local agency shall adopt policies and procedures, including bidding regulations, governing purchases of supplies and equipment by the local agency. Purchases of supplies and equipment by the local agency shall be in accordance with said duly adopted policies and in accordance with all provisions of law governing same. No policy, procedure, or regulation shall be adopted which is inconsistent or in conflict with statute.

54203. If the local agency is a city, a county, or a city and county, the policies provided for in Section 54202 shall be adopted by ordinance in the manner provided by law or by charter, as the case may be.

54204. If the local agency is other than a city, county, or city and county, the policies provided for in Section 54202 shall be adopted by means of a written rule or regulation, copies of which shall be available for public distribution.

APPENDIX B

PROPOSED RESOLUTION

On motion of Trustee....., duly seconded and carried the following RESOLUTION ESTABLISHING RULES AND REGULATIONS FOR THE PURCHASE AND SALE OF MATERIALS, SUPPLIES, EQUIPMENT AND OTHER PERSONAL PROPERTY was adopted:

BE IT RESOLVED BY the Board of Trustees of the Orange County Mosquito Abatement District, Orange County, California, as follows:

SECTION I. PURCHASING AGENT

The District Manager shall act as Purchasing Agent unless another one is designated by the Board of Trustees.

The Purchasing Agent shall, within the limits provided in the Budget approved by the Board of Trustees and except as hereinafter provided, purchase for the District all materials, supplies, furnishings, equipment, livestock, poultry, and other personal property of whatever kind and nature, and except as hereinafter provided, no purchase of personal property by any person other than the Purchasing Agent shall be binding upon the District or constitute a lawful charge against any District funds.

SECTION II. BIDDING REGULATIONS

Any supplies or equipment costing $1,000.00 or less may be purchased without the necessity of notice, advertisement, or the securing of competitive bids or quotations and without approval of the Board of Trustees of said District. This does not preclude the Purchasing Agent from first securing the approval of the Board of Trustees or from securing informal bids without notice, if on occasions, he deems it advisable and for the best interest of the District so to do.

Any supplies or equipment costing more than $1,000.00 may be purchased in the same manner after approval by the Board of Trustees, unless the Board instructs the Purchasing Agent to obtain competitive bids. In this event informal sealed bids shall be secured, without the necessity of newspaper advertisement, from at least three bidders whenever possible, or as specified by the Board.

Any supplies or equipment required by the District which are the same as the goods purchased by the County of Orange from a specific vendor on a contract basis, may be purchased from such vendor if the vendor agrees to extend the same price and conditions to the District.

Any supplies or equipment required by the District may be purchased by the County of Orange on behalf of the District if agreeable to the County so to do, on request by the Board of Trustees to the County Board of Supervisors.

SECTION III. ENGAGE INDEPENDENT CONTRACTORS

The Purchasing Agent may engage independent contractors to perform services, with or without the furnishing of materials, within the limits provided by law, provided that prospective bidders are given full opportunity to submit their qualifications and estimates of cost to render the desired service.

SECTION IV. SMALL CASH PURCHASES

The Purchasing Agent may make cash payments out of his personal funds not exceeding ten dollars ($10.00) for a single purchase. He shall submit periodic claims to the Board of Trustees for reimbursement of all such cash purchases supported by sales slips or other evidence describing each purchase.

SECTION V. EMERGENCY PURCHASING

Emergency purchases may be made by the District Entomologist or by the District Shop Foreman when the Purchasing Agent is not immediately available and the item or items so purchased are immediately necessary for the continued operation of the District, or are immediately necessary for the preservation of life or property. Such emergency purchases shall be subsequently approved and confirmed by the Purchasing Agent, or, if he refuses such confirmation, the Board of Trustees may subsequently approve and confirm such purchase. Unless such purchases are so approved and confirmed by either the Purchasing Agent or the Board of Trustees, the costs thereof shall not constitute a legal charge against the District.

SECTION VI. CONSOLIDATING PURCHASES

The Purchasing Agent shall exercise diligence in consolidating and scheduling orders to the end that the District may benefit from quantity prices and the most favorable market.

SECTION VII. FAILURE TO COMPLY

Any transaction failing to comply with this Resolution in any respect is voidable in the discretion of the Board of Trustees.

SECTION VIII. SALE OF SURPLUS PROPERTY

The Purchasing Agent may sell, as directed by the Board of Trustees, any personal property belonging to the District and found by the Board not to be required for public use, or he may when purchasing personal property accept advantageous trade-in allowances for such property not further required for public use.

SECTION IX. PROCEDURAL REGULATIONS

The Purchasing Agent shall issue procedural regulations to amplify this resolution, which regulations shall be effective upon approval by the Board of Trustees.

SECTION X. CONFLICTING RESOLUTION

Resolution No. 5-A of the Board of Trustees which was passed on October 10th, 1947, is hereby repealed.

SECTION XI. EFFECTIVE DATE OF THIS RESOLUTION

This resolution shall take effect immediately on its passage by the Board of Trustees. Copies of this resolution shall be made available to the public on request.

Mr. Grant: Do you use a purchase order number system in your District?

Mr. Kimball: Yes and no. We have a purchase order number system which we use for the occasional large purchase and for all purchases made by mail. All local and routine purchases are made by signature on a charge account basis.

Mr. Grant: I was also wondering as to your definition of promptly, in regard to payment of claims or charges to the District.

Mr. Kimball: Prompt payment is sometimes necessary to take advantage of the terms of the sales contract. In some cases the terms may allow an additional discount of 2% if paid within ten days. Payment of such claims need not be held for the next meeting of the Board of Trustees since the purchase has already been authorized.

Mr. Gray: One thing that I think should be brought out in connection with purchases, especially for large ones like larvicides, gasoline and oil, one essential part of your competitive bidding is the establishment of specifications. Would you like to go into that at all?

Mr. Kimball: The establishment of specifications is very necessary and sometimes quite difficult when requesting competitive bids. The first step is to consolidate like items to be required over a specific length of time. The proposed rules and regulations which I have submitted recommends consolidation. I will read from Section VI: "The purchasing agent shall exercise diligence in consolidating and scheduling orders, to the end that the district may benefit from quantity prices and the most favorable market." In setting up your consolidating procedures, you have to standardize; and before you can standardize, you have to have specifications. In other public agencies where you have three or four different departments, you can standardize many items and consolidate. In our case, we can standardize to a certain extent, but we have been free to quickly change from one insecticide to another. However, in competitive bidding, and I think that is what Harold is referring to, you have to get down to strict specifications—actually write the details down as to what you want. In this particular manual, it does go into the establishment of specifications. Is that what you had in mind, Harold?

Mr. Gray: I was thinking primarily of specifications in large competitive bids. Most of you know that there are many standard specifications. On insecticides, for example, the World Health Organization has specifications for DDT, Dieldrin and similar things that are recognized universally all over the world; practically all of your principal purveyors of those materials know those specifications and will conform to them. You don't have to adopt all of the specifications in detail; you can adopt them by reference. That simplifies things quite a bit. In the same way, the Petroleum Institute has established specifications on different gasolines, lubricating oils and so on, which are generally recognized as standard specifications in that field. Those are not so much of a problem, but when you come to many of the smaller items, there is a question as to how minutely you shall specify and prescribe. Your County purchasing department, if you have the services of one, may be of considerable assistance. You may examine their specifications on much larger quantities than the relatively small quantity which you buy, and you can either write them in by reference or, perhaps, you even write essential parts in.

One thing that I think you do have to worry about, and that is, don't get yourself involved in too great details, or the tail will be wagging the dog.

Mr. Kimball: Thank you, Harold Gray. You are absolutely right. You may show a saving on a purchase and a loss on mosquito control.

Mr. Gray: Supposing you are going to buy a typewriter. What are you going to do? Set out specifications on this, that and the other detail as to type, size, how fat it should be—it gets you into a mess.

Mr. Kimball: I was surprised when I read the purchasing ordinance adopted by the County of Orange last year. This ordinance specifically states "Competitive bids not required." This ordinance is very similar to those passed by three other Counties in compliance with the requirements of Article 6 of the Government Code. Why does the County put that in any way, yet practice competitive bidding? The only answer that I have been able to find is that it provides a safeguard for those few occasions when they feel it best not to take competitive bids. In other words, they are not tying themselves down by saying that they have to take competitive bids. The fact the ordinance provides that competive bids are not required complies with the intent of Article 6. All public agencies must, however, adopt bidding regulations, but these regulations need not require competitive bidding. So, on the same reasoning, our method of not taking bids under certain circumstances does comply with the law as well as with standard practice.

Mr. Warner: Jack, while you have the floor, may I ask a question? Sometimes when we advertise for bids we have received our lowest bid from outside of the county. Do you purchase outside of the county or do you have a policy on that?

Mr. Kimball: Yes, our Board of Trustees has accepted the low bid from a vendor located outside our District. Although there is no written policy as such, our Board has more or less set the policy by practice.

Our proposed rules and regulations do not regulate this procedure. However, the County of Fresno, by Ordinance No. 473, specifies preference for Fresno County products as well as American made and California made materials.

Mr. McFarland: Jack, isn't it correct that the purchasing manual is all-embracing and primarily designed for large organizations with only a minimum portion usable for our Districts? Doesn't the manual cover consolidation of purchases for many departments in an agency? It would seem to me that the scope of such a manual would leave agencies of our size out of contention.

Mr. Kimball: That is right. In going through the manual you immediately think it doesn't apply to us at all. The manual is written for a purchasing department serving several departments, each of which has the authority to requisition equipment and supplies as provided in their respective budgets. However, after you comb out the parts that are not applicable to our district type organization, you will find that most of the basic regulations suggested by the manual are suitable. Since the mosquito district manager is the fiscal officer, the purchasing agent, and the editor, he is not subject to the checks and balances inherent in a separate purchasing department. Consequently, the proposed rules and regulations which I have presented today limit the manager's purchasing authority to the provisions of the budget as approved by the Board of Trustees.

Mr. Ecke: Speaking of making use of the County Purchasing Agent, nearly all of the uses of mosquito control are rather technical and rather specific, and we found that on numerous items the County Purchasing Agent downtown doesn't have the least idea what we are asking for. We found that by using the little gimmick of saying "no substitutes" in the specifications, we got things that might otherwise take much longer or prove to be unsatisfactory.

Mr. Kimball: I know what you mean. I have been associated with other public agencies long enough to know how difficult it is to operate that way. Mosquito abatement districts, which have such freedom in procurement, probably operate as well as they do for this very reason.

Mr. Moorehead: I would like to add just one thing from our experience with vehicles. We have recently participated with the county, listing our requirements and then taking our needs out of their low bid: but we have found this past year, that with our health district and our mosquito abatement district, that we were able to beat those. We didn't like the prices, so we sent the same specifications out again and we came back with the pick-ups, for example, at two hundred dollars a unit less than the county paid for the ones they bought in the same specifications bracket. So, if you don't like the county's figures, you can get out for yourself.

Mr. Kimball: That is true. Many districts are not in a position to get enough vehicles to get that price. In our case, we only had two, but it takes five to get a factory discount price from the dealer. If you are over a five vehicle purchase, you can make a pretty good deal. Was that true in your case?

Mr. Moorehead: In this particular case, no. We were only after two. The county had sent out their bids for a list for ten needed, and they told us that when ours was placed that ours was the eleventh and twelfth and would be two hundred dollars more than the county ten. So we sent our requirements out again and we came back with a price that was two hundred dollars below the original county vehicles.

Mr. Kimball: Well, it just goes to show—that there is no county like Orange County.

Pres. Portman: Thanks very much, Jack. I know that what Jack Kimball has been talking to us about this morning has been a problem to almost all mosquito abatement districts—that is the problem of purchasing and keeping everyone happy, or trying to.

Is Chet Robinson in the room? Chet, I wish you would come up and make the announcement about the exhibits.

Mr. Robinson: Thank you. In the Windjammer Room, right back there, the exhibitors are setting up their displays and we would very much like you to come out there and see them. There is also, out in front, some heavy equipment. Tomorrow morning we are planning some demonstrations on the golf-course—you can walk over (about a hundred feet)—and we will demonstrate some of the different pieces of spraying equipment there.

When we adjourn here, we would be very happy to have you come back to the Windjammer Room and meet the gentlemen who have the equipment for us to use.

Pres. Portman: Thank you, Chet. We will now adjourn this morning's session and reconvene here at 1:45. I hope you take advantage of the exhibits. I wish to call to your attention that the program which we have planned for the banquet promises to be very interesting.

SECOND SESSION

MONDAY, FEBRUARY 2, 1959, 1:30 P.M.

Pres. Portman: Good afternoon. I see we are already seven minutes late. The first speaker that we have this afternoon is Bill Bollerud, Manager of the Durham Mosquito Abatement District, who will speak to us on "The Evolution of Mosquito Control in California."

EVOLUTION OF MOSQUITO CONTROL IN CALIFORNIA

WILLIAM BOLLERUD
Manager,
Durham Mosquito Abatement District, Durham

I wasn't present at the morning session, as many of you know, and I missed the address of welcome. Many people feel as though they might as well stay at home as to miss the address of wecome. However, if you've heard twenty-seven of them they begin to take on a degree of sameness.

What I have to say was written yesterday and released to the press yesterday. It has been standard operating procedure for these programs to run behind schedule. This time for some unknown reason President Portman is ahead of schedule. Therefore my opening remarks may seem silly and incongruous and out of place. However, we will read it as it was written:

I know what the mis-use of time does on a program like this where important people persistently inch over their allotted time. It drives chairmen, moderators and presiding officers crazy. Before the siege is over it makes each of them a psychopathic wreck. Therefore I have brought with me this mechanical trick for measuring time. It come out of Waterbury, Connecticut. It is a timing device with the sweetest tinkling alarm. Housewives use it in their culinary processes and as reminders generally. It's fair value is about a buck and a quarter and retails for $4.95. I'll set it now for 15 minutes . . .

Now that we're on the subject of time and timing devices, I'll spring a favorite of mine. For some reason my wife does not get much of a bang out of this one.

On this occasion the man of the house had been out on some masculine tour for the evening and returned rather late. When he reached his bedroom and began undressing, his wife opened one eye and sleepily mumbled, "What time is it, Honey?"

"It's eleven o'clock, Dear."

She then raised her head, opened both eyes and looked over toward the bed stand. "It ain't either.. It's half-past three. Where you been?"

"What makes you say it's half-past three?"

"There it is; that clock there shows half-past three as plain as the nose on your face."

Her husband began putting on his clothes again. Now she was really roused and up on her elbow. "What goes here. Where do you think you're going?"

"Lady," he said, "Its time to leave when my wife will doubt the word of her dearly beloved husband and accepts the opinion of a seventy-five cent tin alarm clock!"

Evolution being the title of this dissertation, we'll give you this tid bit: Last summer we did some airplane work in our district, and I suppose most of you did. Also, last summer in the column of "40 years ago" in our local paper we saw this item, which I do not quote verbatim:

Old man Bahmeier had been employed as field man for the Durham Mosquito Abatement District. His salary would be $85.00 a month, furnish his own horse and buckboard. He would be equipped with a 15 gallon drum of stove oil and an oversized flit gun.

Even with our high priced control in 1918 the farmers had to swathe their horses in burlap. They wore nets on their hats, long gloves and tied string around their trouser bottoms.

This modern plane job I spoke of did 160 acres in 40 minutes, but the job cost us more money in 40 minutes than we paid old man Bahmeier in a month. Evolution —revolution, *quien sabe?*

Another innovation which may be revolutionary or evolutionary is that we in Durham have a lady on the Board of Trustees. I know she is not the first one in the state, but out of approximately 300 trustees there are only five ladies.

I like to have ladies at the Board meeting. They have more curiosity and further they serve to keep the meeting clean. Our lady trustee was very curious as to why it cost so much to send a delegate to our annual conventions, so she came along to find out. She's here, and I wish to introduce her—the secretary of the Board of Trustees of the Durham Mosquito Abatement District, Mrs. Marjorie Hoffman. Also in order that you may know that all the disciplines are observed, I will introduce Mrs. Wm. Bollerud.

Some of you may have begun to suspect by now that I hesitate to tackle the subject—the historical, the evolutionary aspects of mosquito control. That's true, and I'll tell you why. Upon reviewing the proceedings of the previous years I find you have been hit with historical sketches too regularly and too often . . . A forward looking body like this can stand only so much of looking backward and still go forward.

Everything that I shall offer today comes out of the proceedings of the twenty-seven conferences. These three tomes set up here are for your inspection. They represent only a fraction of the total. A very complete and comprehensive history of this organization and its work can be found in these volumes and successive ones, if one has the time and the patience to go through them.

Henry Ford, the elder, was frequently quoted years ago as having said that history is bunk. That thought first came to me when I saw these volumes. Referring to these volumes of the proceedings the allegation is denied. It is not bunk. This may be said:

They do contain a great lot of trivia;

They do contain a great lot of repetition;

They do contain a great lot of positive statements by people who didn't know what they were talking about;

They do contain a great lot of scientific data which later became unacceptable.

You can even find in them the assertion that the world is flat. But in spite of all that, you can find in them a very solid core of firm factual stuff submitted by many sincere and hardworking people.

You will find in there the story of the dedicated young professor at the University of California who had concentrated on malaria control. One of the few men in California who realized what an overwhelming thing is malaria, and what it can do to the health, the culture and the economics in a community where half the people are half dead half the time. This, if you please, is our revered Dr. Herms.

You can also find in there the story of a couple of kids who helped him in his research and his surveys in the infested regions of Penryn, Oroville, Durham, Anderson and Cottonwood—Stanley Freeborn and Harold F. Gray.

You may even find an account of Gray's romance. It seems that while at Oroville he found the only woman in the world worth mentioning. As is natural, he married her. He took her with him to Alameda County. She didn't like Alameda County and demanded to be taken back to the Oroville area, which he did, forty years later.

The first conference of the California Mosquito Control Association as we now understand it was held in 1930. There had been earlier mosquito control meetings, independent of one another with no sense of continuity. This particular meeting in December 1930 is the one whose identity has been preserved through a chain of succession. This organization here assembled today was constituted on December 16, 1930. It was designated thus:

CONFERENCE OF MOSQUITO ABATEMENT DISTRICT OFFICIALS IN CALIFORNIA, HELD UNDER THE AUSPICES OF THE UNIVERSITY OF CALIFORNIA, COLLEGE OF AGRICULTURE, DIVISION OF ENTOMOLOGY AND PARASITOLOGY, AT AGRICULTURAL HALL, BERKELEY, CALIFORNIA, DECEMBER 16, 1930.

There were twenty-eight people present; it lasted four and one-half hours, and the proceedings were recorded in nine typewritten pages.

The most outstanding men whose names appear on that first roster were Dr. W. B. Herms and Harold Farnsworth Gray. These two men were the staff and support of the organization for many years.

Dr. Herms made his last appearance at a meeting of this association in 1949, ten years ago. He died before the year was out.

H. F. Gray, although he has retired from active mosquito work, is the one honorary member of this society and is the one and only person here today who was present at that first meeting in 1930. He is still going strong as you will note at the dinner this evening. The program says he's the Master of Ceremonies.

In the 1931 session—the second session—two more prominent names appear on the roster—Professor Stanley Freeborn and Bill Bollerud (God save the mark).

Stan Freeborn is now Provost at the University of California at Davis and a trustee in the Sacramento-Yolo District.

I was a trustee at that time. It doesn't happen often, but occasionally a trustee steps into a managerial position. Carpenter from Pine Grove did so; whether it's promotion or demotion we're not sure. Managers get paid more than trustees.

In 1932 C. M. Gjullin's name appears on the roster. He's been with us since.

Ernie Campbell's name shows in 1935 and Sid Dommes in 1936. I am naming only those who still have their hand in.

In the following several years a great body of bright young men appeared—Robinson, Peters, Geib, Reeves, Sperbeck, Washburn, to name a few. Doggies! it's hard to realize they've been in here twenty years.

Last night, or this morning when you registered you paid $5.00. Now speaking of evolutions, for better or for worse, the registration fee which was established in 1933 was twenty-five cents to pay for putting out the proceedings, and twenty dollars were raised.

In 1945 the receipts of this association were $108.75. In 1957 they were $4,000.00.

A general picture of what has transpired in mosquito control work over the past years may be indicated by the type of subjects stressed in our conventions. A great deal of time in the thirties was given over to oil—larviciding oil. Remember that this is before the day of DDT. Such subjects as:

Spreading coefficient, surface tensions, specific gravity, boiling point, viscosity, kerosene, stove oil, diesel oil, distillate, crank-case oil, cost of purchase, cost of delivery, cost of application. This went on for about ten years.

Simultaneously with the oil hassle were extensive discussions on malaria. We act rather smug sometimes now, but we knew then, as we do now, that empires have been destroyed through malaria. If you will pardon an earlier expression—a country in which half the people are half dead half the time cannot stand. We discussed malaria in Placer County, in Oroville, in Durham, in Los Molinos, in the Black Hills of South Dakota, and even among the Abominable Snowmen of Tibet. We flogged malaria till we literally beat it to death. There is no malaria in California any more, and we don't talk about it any more.

A later topic was Public Relations—just a nice term for how to get along with people—and let there be no mistake, mosquito control personnel have to get along with people. So we had papers and panels and orations on how to get along with the Board of Supervisors; how to get along with the Health Department; how to cooperate with the Highway Departments; how to get along with the Fish and Game people; how to cooperate with the Irrigation Districts; and above all how to get along with your own Board of Trustees! I think the conclusion, if any, was, "Speak softly and don't throw your weight around."

For a while the issue of big equipment to apply oil was uppermost. Bigger districts were being organized. More land, more pasture, more rice. The knapsack sprayer was inadequate. The Jeep hadn't come into the picture yet. Oil was bulky. Some districts put out over 2,000 gallons per day in season. They needed a type of equipment which wasn't on the market.

Fred Hayes of Dr. Morris' Mosquito Abatement District, now Kern County Mosquito Abatement District, described to us a monstrosity such as you might expect to find in a horror picture. He had a West-Allis rubber tired tractor (tires 24x14) which pulled a big trailer with an 800 gallon tank of oil, same size tires 24x14. On top of this outfit someplace he bolted a Model A Ford engine and a Peerless-Bean sprayer. He built a bull pen for the operators and chained them to it—otherwise they would be pitched out in the rough going. It took five men and a water boy to run it. Being in the Bakersfield area they probably would not run out of oil.

For us boys who were used to operating with a three quart flit gun, this was big business.

There was another big deal in spray operations described by the Alameda County crews. The outstanding feature was that they run out 1500 feet of hose. That's over a quarter of a mile. They were probably spraying a segment of the Pacific Ocean.

Then came a device cheerfully called the "plumber's nightmare." You may be assured it was a nightmare to others than plumbers. This was a device for atomizing DDT and sending out a space insecticide in a great flamboyant smoke. The great American public loved it. It was attractive and spectacular, but it was a snare and a delusion. It was made of pipes—big pipes, little pipes, pipes inside of pipes, joints, connections, unions, reducers, expanders, street els, 45's and on and on without end. You couldn't destroy the mosquitoes in a phone booth with it. Ted Raley claimed credit for this.

With the advent of DDT came the great jubilant feeling that science had made a conquest. The optimism was reflected in the papers offered here. For several years the papers and panels were on compounds, formulations and dosages. The desire to get a dosage strong enough to kill mosquitoes and not kill anything else. We had an endless succession of papers on how it will work on larvae—1st, 2nd, 3rd, and 4th instar: on pupae; on adults; on cows, pigs and sheep; on fish and frogs; on wild life. Finally by the time it was proved, if we applied it in recommended dosages, it did not kill fish, nor frogs, nor sheep, nor goats, nor men, nor women—didn't do much to mosquitoes either.

The honeymoon was over, and with it the sad admission that mosquitoes could not be conquered by DDT alone.

Let us not forget that we also touched upon encephalitis. This, like the poor, we always have with us. That's not a prediction. It's a statement of a sad fact. At least we've had it with us so far. There have been discussions on encephalitis and its vectors at every session, but they seem to have reached a zenith in the early fifties.

Following the war the health authorities were fearful of a possible infestation of tropical mosquito-borne diseases, such as yellow fever, dengue, or elephantiasis which might readily be brought in by infected service men. Therefore great impetus was given communities to expand, or form additional mosquito districts. The records show that in 1945 there were 4,600 square miles under control, and that by the end of 1946 there were 11,000. At this moment there are 25,000 square miles including pest and gnat districts.

In 1946 the bill for state subvention became law. This was also prompted by the apprehension of foreign vector mosquitoes getting a foothold. It provided for $400,000 annually to be divided among mosquito control districts.

It seems the law didn't prescribe in detail how this money was to be divided, and there followed an undignified scramble for the funds. Mosquito control managers who had hitherto been sincere scientists and administrators became intriguing politicians. The reports we now get from the state capitol indicate that someone has killed the goose that laid the golden eggs. Could it be we?

Pres. Portman: Bill always gives us a grain of wisdom with a laugh. I think that this contrivance that he has brought up here is well worth while. He told me about it yesterday. He said that he had a surprise, but I didn't know whether or not it was one of those pocket watches with an alarm, you know the type. Somebody used one at the AMCA convention last year, and set it up to time himself. I think it is a very good idea to keep everybody on time, and if somebody does get long-winded—ding.

The next speaker that we have is Mr. Ed Munson. He is Director of Sanitation for the Monterey Health Department and, you might say, is the father of mosquito control in this Salinas Valley area. I don't know how long he has been interested in mosquito control and working for it; but I do know it has been for at least ten years. Ed is going to speak to us today on "Mosquito Control and Allied Agencies."

MOSQUITO CONTROL AND ALLIED AGENCIES

EDWARD W. MUNSON

Director of Sanitation,
Monterey County Health Department

Adequate mosquito control measures cannot be accomplished by one department. Mosquito abatement activities should not be isolated steps taken by a single agency, but rather such activities should be the result of well coordinated planning by a number of agencies. An effective control program must be predicated upon one department's interest and cooperation in the activities of several other governmental agencies and in return it must receive a friendly sincere and helpful response.

The day should be gone forever when one department will attempt to stand completely on its own and isolate itself from other groups which have common interests. Only through cooperation and mutual assistance can maximum service be rendered to the public at a minimum of cost.

So much for platitudes and high sounding phrases. Now let's turn our attention to some practical applications of these theories.

To be successful a mosquito control agency must have the cooperation and assistance of the highway

and road departments. Many of you know only too well what can happen when a fill is laid across a marshy area without proper thought for future mosquito control measures, or when culverts are not installed to exacting grades. Even minor road grading can sometimes create temporary control problems. On the other hand, roadside weed control programs carried on by the road department can be of immeasurable value when they are planned and executed to facilitate mosquito control measures. Mutual assistance can also be rendered by one department to the other in times of need through the loaning or exchange of equipment. One example might be equipment which the mosquito control agency could make available to the road department in time of flood and later on in return receive some other form of assistance when the flood waters recede and mosquito problems become a factor.

It Must Be Remembered That Cooperation Is Not A One Way Street

Mosquito control agencies and planning departments may not at first glance have much in common. However when viewed more closely there are many areas where planning and zoning without regard for mosquito control problems could result in a wasteful expenditure of the taxpayers' money. Mosquito control agencies are unquestionably interested in the proper planning of new subdivisions. Particularly with respect to the adequacy of storm drainage measures. The proposed location of industries is of basic concern to those engaged in mosquito control. Of particular concern are those industries which have large volumes of wastes to be disposed of or whose wastes have a high organic content. Frequently the BOD of an industrial waste doesn't just mean a bio-chemical oxygen demand but it also means "Bring on Disaster" as far as prolific mosquito breeding is concerned. Too often mosquito control agencies are ignored in the planning and design stages of industrial waste holding ponds and are only taken into consideration after an intolerable condition has arisen. It is therefore easy to see that as far as mosquito control is concerned, planning and programming go hand in hand and that the Planning Director of Community and the Director of the Mosquito Control Program must have a mutual understanding and appreciation of the other's problems.

Flood control districts by their very nature can be both an ally and a foe of mosquito control. Through the control of excessive storm run-off they prevent flooding of lowlands, check excessive erosion of river beds and retard the development of gullies which may contain pockets of standing water. In these respects flood control measures materially assist by preventing conditions which otherwise would increase drastically mosquito control problems. On the other hand the construction of dams and reservoirs without due consideration to mosquito control measures often results in a headache to the control agency. This is becoming more and more apparent throughout the state, particularly around the dams and reservoirs which are also used for recreational purposes. One has only to observe the tremendous drawing power of a lake suddenly created in a previously arid area to realize that the thousands upon thousands of recreational enthusiasts will not be content too long if either mosquito or gnat nuisances are much greater than they are used to in their home communities. Yet by their very presence these thousands add to the problem already present through the misuse of the facilities provided. It is problems of this type that add grey hairs to the heads of Directors of Mosquito Control Agencies. Yet through proper pre-planning many of these problems are being met and overcome.

Soil conservation districts are usually an ally of mosquito control agencies and in many areas excellent cooperation and understanding exists. However, there is the always present possibility that check dams and stock watering reservoirs will become focal points of heavy mosquito breeding should there be a relaxation of vigilance on the part of either agency. Fortunately most stock men are well aware of the resultant weight loss that their herd would suffer should such a condition occur so they too aid in the practice of practical mosquito control by becoming an ardent ally of the mosquito control agency.

The Agricultural departments and the Farm Advisors have been friends of long standing of the prudent mosquito control director. Probably no one group can do more to smooth the path of the mosquito control agency than can the enlightened farmers in the proper application of irrigation practices. Conversely poor irrigation practices can cause sleepless nights for not only those engaged in mosquito control but literally for entire communities as well. If I were charged with the responsibility of mosquito control I know of no individual or individuals I would rather have as friends than I would an Agricultural Commissioner and Farm Advisor who are sold on the value of mosquito control.

To carry on a completely successful control program the mosquito control agency must have an intimate knowledge of the innermost plans and programs of the health department. For anything less than complete cooperation to exist between health departments and mosquito control agencies is unthinkable, for their very basic existence is founded upon identical services to the public—the prevention of disease. Each agency must be aware of the problems of the other and must understand that it sometimes takes considerable time to effect necessary corrective measures. However, when both agencies know the goals the other is striving to attain then the sometimes seemingly long time necessary to obtain corrections is more tolerable through the balm of understanding. One example might very well be an area in which septic tanks fail to function satisfactorily. While both agencies deplore effluent overflowing the surface of the ground, the difficulty of maintaining satisfactory control measures is made easier if the control agency knows that the health department is making a reasonable effort to persuade the area to provide sanitary sewers or annex to an adjacent community where such facilities are already available. The moral to this is to get to know your Director of Sanitation, explain to him what your problems and goals are, listen to his long, sad tale of woe and then mutually try to solve the problems together without too much care as to who gets the credit.

An example of cooperative action was demonstrated a short time ago when a heavy infestation of *nigromaculis* occurred in irrigated pasture on a ranch approximately thirty miles south of our mosquito abatement district's southern border. This might not seem alarming to many of you but to us it was the first time

we had experienced the ferocity of the pasture mosquito. In fact conditions got so bad that workers in an adjacent field refused to continue to work and walked off the job.

The Board of Supervisors asked us to do something to alleviate the situation, so the mosquito abatement district and the health department checked out the problem. After control costs were estimated, the Board of Supervisors appropriated the necessary funds and the mosquito abatement district undertook control measures. We didn't stop there though. Next we asked the Soil Conservation District to assist. They made a survey of the permanent pasture area, recommended regrading some fields and changing irrigation practices on others. The rancher cooperated and the problem gradually corrected itself. This is, in my opinion, a good example of unselfish action upon the part of the mosquito abatement district, and clearly demonstrates the value of friendly cooperation on the part of three agencies.

Another area where health departments and mosquito control agencies can be of great mutual assistance is in the area of civil defense and disaster relief. Usually mosquito control personnel can spend the first few days assisting to some degree with purely public health problems and then in turn, by the time the most critical health department problems are partially under control assistance can be given to the health problems of the control agency. Many of you may not agree with this, and in many instances you may be right. However, I have an unshakeable faith that in time of crisis I can turn to our mosquito control agency and secure their wholehearted support within the limits of their ability to provide it. I am also sure that they feel the same way about the health department.

Just as no man is an island, no department can stand alone. Thus mosquito control is rightly the business of several agencies.

Pres. Portman: Thanks, Ed. The next speaker we have is Mr. Stuart Juiffre, Superintendent of Casualty Division of the Fidelity and Casualty Company, which is a member of the America Fore Loyalty Group. Mr. Juiffre.

INSURANCE FOR PUBLIC AGENCIES

STUART C. JUIFFRE
Supt., Pacific Casualty Division
The Fidelity & Casualty Co. of N.Y.
America Fore Loyalty Group
San Francisco

When Mr. Smith wrote me concerning this engagement, he was kind enough to send along suggestions supplied to all your speakers on the preparation of manuscripts. In those suggestions was a reference to underscoring genus and species names. Genus and species are terms which are very familiar to you but which are not common in the insurance industry, however, there is no reason why they could not be adapted to insurance. While your program indicates this talk is to be on the subject of insurance for public agencies, which would mean all forms of insurance, I am going to talk on what I feel is one of the most important forms of coverage for your operations—Genus Public Liability Insurance—Species Automobile Liability Insurance and Species General Liability Insurance.

The genus Public Liability Insurance is a form of coverage that protects the legal liability of the insurance buyer against claims or suits made or brought by the general public for such bodily injury, including resulting sickness, disease or death and property damage that may result from the insured's actions.

The species Automobile Liability Insurance as a general term applies to the various coverages affording protection to the owner or operator of automobiles.

The species General Liability Insurance consists of a number of coverages protecting the insured for the ownership, maintenance or use of premises and elevators, liability of others assumed under written contract, liability for the sale of his product to others, for liability as exists after completion of operations performed and for liability as may exist on the part of an insured when independent contracts are performing work for him. There are a few other minor General Liability Coverages, the ones mentioned are the main ones.

Until about twenty-five or thirty years ago these forms of insurance were purchased under individual policies. From the time Public Liability Insurance came into use, the different coverages were supplied by insurance companies as the need arose, like Topsy "we just growed," and policies were designed for each form of insurance. Gradually the schedule liability policies combining the several General Liability hazards into one policy came into use. Under the schedule form each coverage had to be purchased separately and automobile insurance was still written under a separate contract. The best an insurance buyer could do in purchasing Public Liability Insurance was two separate policies, one for General Liabilty and one for Automobile Liability and great care had to be exercised to see that he secured under each policy the various coverages for adequate protection.

There then appeared on the Pacific Coast a new form, one policy that included the Automobile and the General Liability coverages, and in addition had the important feature of automatic protection, subject of course to certain specified exclusions. This form, which remains in use today, is formally known as the "Comprehensive General—Automobile Liability Policy," it is the form of coverage you should have for it is the broadest protection available. It is in widespread use here on the Pacific Coast, especially in California, and is becoming more and more popular in the rest of the country.

Let's illustrate the difference between the old and obsolete individual or schedule General Liability policies and the Comprehensive General—Automobile Liability form. A store owner had purchased a policy to protect him against claims made by the general public for injuries sustained in or around his premises. He would have had either an individual policy which we called an Owner's, Landlord's or Tenant's contract or he would have purchased the coverage under the Owner's, Landlord's and Tenant's section of a schedule form. Suppose he decides to expand and contracts with

an independent contractor to build an addition. In the course of construction a passerby is injured and brings suit against both contractor and owner. Unless the owner had purchased insurance for this specific hazard, he had no protection under the old forms. Under the comprehensive form, he is automatically protected.

Let's take a common situation in Automobile Insurance as a further illustration. It is a well known principle of common law that an employer can be held responsible for injuries or damage done to the general public by an employee who is involved in an accident while using his personal car on the employers' business. Under the old form of Automobile policy, the employer would have no coverage for this incident unless he had been prudent enough to arrange for an amendment of his policy. Under the Comprehensive form of coverage, the insured employer would have the necessary protection.

We don't want to mislead you into thinking that this broader form of protection is furnished free of charge. The customary procedure is to survey the exposures of a risk prior to policy issuance and charge premiums based on the known hazards. Appropriate premiums for exposures not existing at time of issuance are charged for after expiration of the policy when an audit is made. The important feature of the Comprehensive General–Automobile Liability Policy is that the coverage is afforded without the insured having to notify his agent or carrier of an additional exposure.

Neither do we want to have you think the Comprehensive General–Automobile Liability policy will provide coverage for everything or anything. The word "comprehensive" is defined in one dictionary as "including much" also as "full" and as "complete." The definition "including much" fits this policy, to regard it as full or complete insurance would be incorrect and misleading.

Perhaps a brief review of the Insurance Agreements and Exclusions of the policy would be beneficial to illustrate the "including much" aspect of this contract.

The first insuring agreement is applicable to Automobile and General Liability coverages and provides that the carrier will pay on behalf of the insured all sums which the insured becomes legally obligated to pay as damages for bodily injury, sickness or disease or death resulting therefrom caused by occurrence. Note the phrase "legally obligated." An insurance company will not pay money as damages to a party injured on the insured's premises when the injured is hurt because of his own fault and there is no negligence on the part of the insured. We use the term "bodily injury" rather than "personal injury." Our phraseology is restrictive, "personal injury" would include such torts as libel, slander and false arrest. In addition, because we insure on an "occurrence" basis rather than on an "accident" basis, we impose further limiting phrases, which were not quoted, to restrict the coverage to unintentional acts of the insured for obvious reasons.

The next two Insuring Agreements refer to property damage coverage, one for automobile and one for other than automobile, or general liability. In both we again use the term legally obligated and impose a further restriction by saying "caused by accident" rather than "caused by occurrence." Generally speaking the word accident may be regarded as a sudden, unexpected and undesigned event, identifiable both as to time and place. An occurrence may be unexpected, but can take place over a period of time and usually cannot be tied down to any specific time. For example, there might be an explosion in a manufacturing plant resulting in damage to adjoining property, that would clearly be an accident. However, if the plant were emitting smoke which gradually deteriorated the surrounding property, that would be an occurrence.

The next insuring agreement, relating to Defense, Settlement and Supplementary Payments is important. Here the company agrees to defend the insured against any claim or suit, even if false or groundless, but only with respect to coverage afforded by the policy. In addition, the claim or suit must seek damages, we would not, for example, defend an insured in an injunction proceeding where the purpose of such proceeding would be to prevent an insured from doing something and where no damages are sought. We also reserve the right to investigate, negotiate or settle any claim.

We agree to pay premiums on bonds to release attachments for an amount not in excess of the policy limits and to pay premiums on Appeal Bonds, but we do not obligate ourselves to apply for or supply such bonds. Other payments to which the insurance carrier obligates itself under this insuring agreement are costs accessed against the insured other than damages, such as might accrue after a judgment has been entered until the insurance carrier has paid or deposited in Court that part of the judgment that is within the policy limit, such immediate medical and surgical relief expense as may be incurred by the insured in affording such services to the public as are imperative at the time of an accident and reimbursement to an insured for reasonable expenses incurred at the carrier's request other than any loss of earnings.

All of the payments required of the carrier, under the Defense, Settlement, Supplementary Payments insuring agreement, other than the actual settlement of the claim itself are paid in addition to the limit of liability as noted in the policy.

The next insuring agreement is the one wherein the company defines who is regarded as an insured under the policy contract. Here, we split this into two parts, one, pertaining to who is the insured with respect to the general liability coverages, and the other, to the automobile liability coverages.

As far as General Liability is concerned, an "insured" would include any one who is named in the policy, we refer to such persons, firms or corporations as the named insured, and, in addition, we include executive officers, directors or stockholders of the named insured while they are acting within the scope of their duties, as respects partnerships we include the partner but only with respect to his liability as such and we also include any organization or proprietor with respect to real estate management for the named insured.

As far as the Automobile Liability coverages are concerned, we again include the named insured and in addition any person while using an owned automobile or a hired automobile and any person or organization legally responsible for the use thereof, provided that the actual use of the automobile is by the named insured or with his permission. Also included is an executive officer of the named insured who is using in the

business of the named insured any non-owned automobile, in this respect, we mean an automobile that is neither owned nor hired by the named insured or the executive using it.

The final insuring agreement is one which defines the time limit and the territory covered by the policy. The policy only covers accidents occurring during the term of the contract and they must occur within the United States of America, its territories or possessions, or Canada. The territorial restriction is a recognition of the problems which many insurance carriers would face if they were required to process claims brought in from far-flung lands.

The exclusions of this policy can be divided into three basic categories. First, there are rating exclusions, in other words these relate to hazards which can be insured under the policy for an additional premium charge. Secondly, we have what might be called "other coverage" exclusions or those exclusions which pertain to hazards which are insured under other forms of insurance. Third, there are exclusions for hazards which underwriters feel are not subject to being insured or are so tremendous that no Insurance Company could reasonably be expected to provide coverage for them.

The first exclusion is a rating exclusion. It pertains to the elimination of liability assumed by any insured under any contract or agreement except contracts as defined in the policy. The definition of contract specifies that it must be in writing and includes a lease of premises, easement agreement, agreement required by Municipal ordinance, side-track agreement, or elevator or escalator maintenance agreement. For example, when you are leasing office space in a building you ordinarily agree to hold the owner harmless for claims resulting from accidents occurring on the premises. Such assumed liability is automatically covered by the policy and without additional charge. If, however, you sign an agreement with a farmer for whom you were going to do some mosquito control work requiring you to hold him harmless from claims arising from your operations, the liability you assume there would not automatically be covered by the policy, the contractual liability exculsion would apply but you could eliminate the exclusion by payment of an additional premium.

Other examples of rating type exclusions are the ones pertaining to watercraft, when away from the insured's premises, and the water damage exclusion wherein we eliminate coverage for damage done to the property of others by water coming from your premises, except in the case of fire. For example, should any of your offices include restroom facilities and a sink were to overflow seriously damaging property of another tenant in the building, there is no coverage under the policy. Both the watercraft and the water damage exclusions can be eliminated for an additional premium.

Some examples of the "other coverage" exclusions are two pertaining to your employees. Bodily injury or death sustained by your employees in the course of their employment is covered under Workmen's Compensation insurance. With respect to Automobile Property Damage coverage there is an exclusion of property owned, rented or in your charge other than a residence or private garage damaged or destroyed by a private passenger automobile covered by the policy. The intent of this policy is to cover damage done by the insured to members of the public, consequently we do not cover damage to your own automobiles or trucks. There is another form of coverage for that hazard. With respect to General Liability Property Damage, there is no coverage for property owned, occupied by or rented to an insured. There are other forms of insurance, such as Fire insurance, available to cover this hazard. There is an exclusion of property in the insured's care, custody or control or property which the insured, for any purpose, is exercising physical control except as respects liability assumed under side-track agreements or the use of elevators. Here again there are other forms of insurance protection available. There are coverages available for the ownership, maintenance or use of aircraft, consequently this is excluded except when aircraft are operated on an insured's behalf by independent contractors.

One of the hazards excluded which underwriters do not feel are insurable, is damage to the work completed by an insured or the product sold by an insured out of which an accident arises. For example, should a contractor build a building which collapses due to some defect, there would be no coverage for damage to the building in question. Should a manufacturer sell a toaster that is defective and which causes a fire, the damage done, except damage to the toaster itself, would be covered. These are hazards which we feel are normal business hazards of any insured risk and ones which they should bear.

We have attempted to highlight the insuring agreements and exclusions of the policy. In so doing, we merely wanted to bring to your attention the things we felt you would be most interested in. There are other points of coverage and exclusion which time does not permit us to discuss. Your policy should be reviewed for a thorough understanding of its terms. We hope you don't have the impression that this is after all not a contract that includes much for it is the broadest form of protection available and the one which you all should carry.

On the necessity of your carrying Public Liability insurance, as far as Automobile coverages are concerned, that is probably self-evident. No thinking person, firm or organization will use automobiles without carrying insurance. There is no lack of statistics on the number of accidents and the cost of those accidents and even children know that if anybody is hurt in an automobile accident they collect money.

In the event you have any doubt about the need for carrying General Liability insurance let's quote from an article appearing recently in a San Francisco paper. The headline, "$100,000 suit over dead frogs"; dateline, "Bakersfield, January 21st"—"A one hundred thousand dollar damage suit was filed here today charging that one hundred thousand frogs on a local frog farm were killed when sprayed with anti-mosquito poison.

"An employee of the (blank) County Mosquito Abatement District was accused in the suit of being the mass executioner of the frogs."

There is no necessity to quote further, you are undoubtedly very familiar with this case. If any of you were not carrying General Liability insurance, you probably made arrangements to do so after hearing this news. If you haven't already done so, I would not be at all disturbed or hurt, and I am sure your Presi-

dent will feel the same way, if you left right now to telephone your insurance representative to arrange such coverage.

No discussion of the genus Public Liability insurance would be complete without some mention of the limits of coverage to be purchased. Unfortunately, we cannot tell you that for Bodily Injury, you should purchase a certain amount of coverage for one person and a certain amount per accident or occurrence nor could we do the same as respects Property Damage coverage. This is something that can only be determined by each individual insured in consultation with his insurance agent and possibly with his insurance company. We are not familiar enough with all of your individual exposures to advise you that a certain limit of coverage would be suitable for your needs. You can best judge the hazards of your daily operations and the daily use of automobiles. These should be considered and you should purchase an amount of coverage which you are reasonably certain would be adequate for you. We can advise you on one point, do not be misled into thinking that it costs a lot of money to carry substantial limits. Proportionately, the increase in premium for higher limits of coverage is very reasonable when compared to the amount of increase in protection. This can be easily illustrated merely by asking your insurance representative to give you a quotation for limits of coverage in excess of what you are now carrying. We think you will be pleasantly surprised.

You will all be interested in the background of a recent development with regard to the rating of your General Liability insurance coverage. The program was developed through the close co-operation of your Insurance Committee, primarily through the efforts of your Mr. Smith, and the Insurance Industry, specifically the National Bureau of Casualty Underwriters, an organization that acts on rating matters for the leading Casualty Insurance Companies. This is a perfect example of the good that can result from the co-operation of two separate groups who want to reach a common objective satisfactory to all.

There was considerable uncertainty in the insurance industry with respect to the classification and rating of your operations. You see, we have established, over a period of years, various classifications for insurance purposes, each classification having its own rate and premium structure developed over a period of time on the actual experience of risks falling within that particular group. We recognize that we do not have a specific classification for every conceivable type of operation, that would be an impossible task, consequently, when we write insurance on risks not specifically classified in our manuals we do so on the basis of analogy, we select a classification that we have which, to the best of our judgment, specifically fits the operations and hazards of the particular risk we are considering. Because of the diversity of your operations there were at least three general liability classifications being used by companies to insure and charge premium for your exposures. One classification was irrigation or drainage system construction which probably accurately describes the operation of some of your districts. Another one was grading of land and, still another, tree pruning, dusting, spraying, repairing, trimming, or fumigating. Certainly some of your districts could conceivably come within the land grading class, others could conceivably be properly classified under the tree spraying, etc. class. The difficulty in applying these classifications was that some of your districts quite possibly should have been assigned to two of them, or again the insurance underwriter classifying the risk might assign the tree spraying class to a district whose activities were primarily in the irrigation, drainage ditch construction or grading of land field, simply because he did not have information at hand, at the time, to know what the exposure was and the last mosquito abatement district he had underwritten had been classified by analogy under tree spraying.

If you were confused when you received an insurance policy classifying you under the grading of land group when your primary activity was spraying, these are the reasons. In our defense we point out that your coverage was written by a number of different companies, each of whom might have a number of underwriters handling different territories with the result there was no coordination or common thinking on our part.

In the latter part of 1957, Mr. Smith brought this to the attention of the National Bureau, and asked that the insurance industry work with your association to establish a definite rating procedure.

In the early part of 1958, a meeting was held between your Messrs. Portman and Smith, Mr. Richard Peters, of the Buerau of Vector Control, Dr. Irma West of the State Health Department and Mr. Charles Riise, Agent for the Association, and the General Liability Committee of the National Bureau. There was a general discussion and we requested additional information from Mr. Peters, which he shortly supplied and which in a sense was the determining factor in our being able to promulgate a rate which, we felt, would adequately reflect the hazards of your activities and, at the same time, be fair and equitable. What Mr. Peters was able to give us was a breakdown of your overall operations. It appeared that 45% of your over-all activities was spent in administrative and technical services with inspectional and negotiating activities. We felt that a classification we had not previously used would be analogous to these activities, consequently we took 45% of the rate for our classification "Engineers or Architects—consulting—not engaged in actual construction" as the first part of your over-all rate. Apparently 35% of your over-all operations involve chemical larviciding, chemical adulticiding and maintenance operations. Our feeling was that the tree spraying classifications, previously mentioned, was most appropriate to these activities and we added 35% of that rate. Twenty per cent of your over-all activities concerned mosquito source reduction, we felt the grading of land class would be appropriate here and took 20% of that rate. We then totaled those rates and added 10% to include the completed operations' exposure. The rating established contemplates injury or damage that may take place either while your various activities are being done or after they have been completed.

We established a new classification specifically for your operations, "Mosquito Abatement Districts—including completed operations—including clerical employees." The purpose of including clerical employees was to make the classification all inclusive so that the

rate, when applied to total payroll would produce a premium reflecting all hazards. We also agreed to include payroll of drivers and chauffeurs due to the mixed duties of such personnel.

As previously mentioned, the policy form we have discussed excludes coverage for the operation of aircraft except such liability as you may have when aircraft are operated on your behalf by independent contractors. Consequently, should you arrange with an independent airplane owner in spraying on your behalf, your liability would be automatically covered by the policy. Our Committee felt that as regards this hazard there was a great similarity between your operations and those of the normal farm risk. Inasmuch as our coverage on farm risks specifically excludes any such liability, we felt it not unreasonable to impose the same restriction as regards your operation, and we, therefore, supplemented your new classification with a footnote reading as follows:

"This classification excludes coverage for injury to or destruction of property arising out of any substance released or discharged from any aircraft in connection with dusting or spraying operations."

You will note that this exclusion relates only to property damage, consequently, coverage is automatically granted as respects bodily injury, sickness or disease, including death resulting therefrom, which may occur when aircraft are being operated for spraying purposes by independent contractors on your behalf.

Now that you have a specific classification for General Liability insurance applying to your operations, just what does it mean? By way of explanation, let's discuss the operations of the National Bureau of Casualty Underwriters. This is an organization that operates on behalf of the majority of insurance carriers for the purpose of establishing public liability rates and forms of coverage. Its actions are guided by committees made up of its member companies. Without such an organization it would have been impossible to solve the rating problem that existed in your industry.

Insurance rates are based on the law of large numbers, the more premiums and losses that are used to determine the rate of a group of risks, the more accurate that rate will reflect the exposures. The member and subscribing companies of the National Bureau organization file with them at regular intervals their premiums and losses for each type of risk insured. On the basis of that information, adequate rates are promulgated which allow insurance companies a reasonable margin of profit and which are not excessive with respect to the insureds. As far as your operations are concerned, all premiums and losses will be reported to the National Bureau under a code number and on that information average rates will be promulgated applying to all of your organizations. You can imagine the rate making chaos that would exist if the services of such an organization were not available. Suppose one insurance carrier provided coverage for five of your districts, received a nominal amount of premium income but had sustained some serious losses. If they were determining their own rate, the cost of insurance to the districts they covered would go way up. On the other hand, another company might insure fifty of your organizations, have received a more substantial amount of premium and suffered only minor losses. Their rate would go way down, but neither rate would reflect the over-all hazards.

The rating that has been established for you is a judgment rating which we feel is a reasonable and good starting point. In due course of time, as experience develops, the rate will be adjusted to reflect the actual experience of your operations. It boils down to a very simple fact, you will determine your own rate.

How should you purchase your insurance protection? While this talk has been confined to the genus Public Liability insurance, these final remarks will apply to any insurance coverage you buy.

Find out a little about the insurance company writing your policy. One of the best ways to do this is to ask a few questions as follows:

Is the company financially sound? Is the company generally respected by other insurance companies? Does it have a reputation for prompt claims settlement? Does it resolve honest differences of opinion in a claim's dispute objectively instead of giving the narrowest construction possible to its policy provisions? Is it recommended by leading insurance men? Does it belong to recognized rating and company trade organizations or at least subscribe to principles adopted by such organizations? Has it a record of stable development in all insurance matters as contrasted with frequent change in its policies, underwriting standards and services? Does it offer truly valuable engineering and inspection services?

An affirmative answer to every question indicates that the company is excellent. More than one or two negative answers should prompt you to reject the company you are considering.

Finally, purchase your insurance through competent local agencies. We do not mention this last because it is any less important than the selection of an insurance company but rather because we want to emphasize it as a final point. Your local competent independent insurance agent is the insurance man closest to you who will be more familiar with your needs. He will help you in determining what coverages you should purchase and will assist you in purchasing the maximum protection for the lowest possible cost. He will aid you in keeping your insurance program up to date so that you will have the latest coverages and so that you can continue having the maximum protection.

If you follow these suggestions in purchasing insurance coverage, and make certain you have a Comprehensive General—Automobile Liability Policy, you will have what insurance is intended to provide—Peace of Mind.

Question: Is it advisable to put one's insurance out for bids?

Mr. Juiffre: That is generally advantageous. What happens sometimes when you put your insurance out to bids, is that it is bid on by a lot of different companies and there are times when companies not of the type we think we are, will put in the low bid and insurance is purchased from that company. That is a mistake. The low bidder isn't always the best company. Now, if you are going to put out your insurance for bids with the idea of not necessarily committing yourself to accepting the low bid, but only doing so after satisfying yourself that the company in question is a good company, then there is no objection to it.

One thing, if you do put your insurance out to bids, give your companies a little bit of time to make up the bid and so forth. Don't publicize your bid specifications —and, incidentally, you should set forth definite specifications for any bidding proposition, whom you want covered and all the exposures and so on—don't publicize your specifications on the first of the month and ask the company to give you a figure about seven days later. It is nearly impossible.

Question: Do I understand that it is written all in one policy: covering automobiles and liabilities?

Mr. Juiffre: That is general liability. Yes sir, it is all written in one policy.

Question: Some of the companies we have approached do not write both automobile and general liability coverages. Does your company do that?

Mr. Juiffre: Yes. Most companies write both automobile and general liability insurance. Now, there are companies that more or less specialize in automobile insurance. If you were going to purchase your automobile insurance from them, you have an automobile policy but you would have to purchase a separate general liability policy from another company. It is wise to keep your automobile insurance and your general liability insurance in one company. This is the reason. There is an interlocking of coverages to some extent, and there would be in your case from what I understand of your operations. If you use a lot of trucks and vehicles and go around doing spraying, there would be a question as to whether that came within the confines of automobile liability insurance; some might hold that that might be general liability insurance. You can see the position that you would be in if your automobile insurance company took the position that it was general liability insurance and your general liability insurance company took the opposite position, saying it was automobile insurance. You would be in the middle.

Question: Your company would write this under the Fidelity and Casualty? Is that right?

Mr. Juiffre: That is one of the companies in our group. Yes.

Question: Your company will participate on a competitive bidding basis, won't they?

Mr. Juiffre: Yes. Let me emphasize a point on competitive bidding. Don't purchase your insurance strictly on the basis of price. Price isn't everything. Just like in any other field. You can buy cheap clothes and good clothes, etc.

Mr. Portman: I would like to ask your opinion as to the practice of placing one's insurance in the hands of an insuring Association. We have done so and proceeded on their recommendations. They are supposed to look out for our welfare and I believe they have done so, but I would like to know what is the opinion of insuring concerns on dealing that way.

Mr. Juiffre: We feel it is good. Mainly because it results in better protection for you. My company may lose one line of your district's insurance program because of such a situation; but my company, or any other competitive company would rather see it handled that way because your insurance needs are taken care of more efficiently. You know what you have. You know who has it. I dare say that the combination of agents that is handling your program looks after it very well on that basis. The old system of letting Joe write your automobile insurance, giving Mike the Workmen's Compensation Insurance, and somebody else the aircraft insurance is all right. You make a lot of friends and you keep a lot of people happy, except when one finds that he has a smaller part than his best competitor. But, it sometimes works out that you are lacking coverage; so we advocate what you have done. We think it is a fine idea and we are happy to write insurance on that basis.

Mr. Enos: Under general liability, are the general employees of the district as well as members of the board protected between the time that they leave home and the time that they get to the board or headquarters and from there back to their home?

Mr. Juiffre: Are you talking about injuries to themselves, sir?

Mr. Enos: No. For protection on actions pertaining to the District.

Mr. Juiffre: The basic policy which I talked about does not protect employees of the districts at all. If I were an employee of the district and I were out on a spray truck and within the realm of general liability coverage hurt someone resulting in suit brought against me as well as you, I would have no coverage. That exclusion can be eliminated, or coverage can be provided for a nominal additional premium charge. We hope that some day this type of policy will be redrawn so that it includes that right in the basic policy structure. It is a good idea to have your employees covered.

Mr. Gray: I think what Mr. Enos was thinking about was in regard to the board of trustees in their official capacity in attending the meetings. If I recollect, shortly before I left the Alameda County District, that we set up insurance protection by a special clause—a rider attached—and there was an extra premium on it, to take care of that particular liability of the trustees and also to protect each individual trustee and the manager from general liability, but that was a rider with an additional premuim, not in the basic policy. But I think that the trustees are protected that way, Ed.

Mr. Juiffre: I see your point. Yes, that can be done, and is often done. The practice these days is to name just about everybody that can conceivably be involved in the suit, and to name the board of trustees, or even individual trustees, would be comparable with what I said we automatically cover, the directors of a corporation while acting within the scope of their duties. That would be the same situation.

Thank you very much, gentlemen, for asking me to come and present this information on insurance for public agencies.

Pres. Portman: We will now have a fifteen minute recess and reconvene here at 3:35 p.m.

Mr. Gray: I have one announcement. Howard Greenfield has the chicken-pox, and I have a little sort of a get-well message for him. I would appreciate it if those of you who know Howard would get hold of me and sign it.

RECESS

Mr. McCauley: Ladies and gentlemen, members of the California Mosquito Control Association:

I am a substitute for Bud Glikbarg, who couldn't be here; and if I have to read my speech, it is because in

volunteering to take Bud's place I didn't realize how long it would take to get my arm untwisted after Howard got through talking to me. So, I didn't have too much time to go over my speech after I wrote it.

I will do one thing—I don't think you have to worry about the time, because I will try to continue on with the same vein and keep you ahead of schedule—I will follow Bill's last remarks, though, and talk primarily about public relations. The title of the paper that I have prepared is:

PERSONNEL POLICIES

EDWIN R. MCCAULEY
Assistant Administrative Officer
Monterey County, Salinas

Mr. President and Members of the California Mosquito Control Association:

No doubt by this time you have been officially welcomed to the County of Monterey. Perhaps it might be in order for me to give you an unofficial welcome at this time.

After reviewing your very complete program, I can only conclude that the life of the mosquito is going to be more difficult in the State of California after the conclusion of these deliberations.

Before reviewing the various aspects of a good personnel program, I should like to first point out how much of the typical governmental agency's budget is spent on personnel. I am not familiar with the details of the budgets under which you operate. However, in most governmental agencies the personnel costs run from 50 to 70% of the total annual budget. It is axiomatic that if you have sound personnel policies a substantial savings to the taxpayers can be made. There are several aspects to a good personnel program, and I shall review each of them with you briefly. The items that we will consider are classification plans, salary surveys, administration of a salary plan, recruiting, vacation, sick leave, leaves of absence, holidays and physical examinations. As you will note, the first item I mentioned was a classification plan. This was placed first on the list because it is the basic plan or frame work of a good personnel program. The classification plan can be relatively simple in a small organization. It becomes increasingly complex as the organization becomes larger. Basically it consists of a brief description of a scope of duties that an employee or employees may be called upon to perform. For instance, one class specification may be that of a light truck driver. Duties of all of the people in the organization who do similar work would be described in a general way in this specification. You may have other people in your organization who are mechanics. You would have a broad statement of duties that would fit the mechanical work that would have to be performed in your organization. A title, of course, is an important part of each specification and should be brief and descriptive of the type of work performed. The class specifications, of course, are used as the basis for establishing salaries, and I like to think that the salary rate is the price tag which is attached to a class specification. It also serves as the basis of your recruitment program.

Next, I would like to talk about the salary plan. This is always an interesting problem and certainly a baffling one to all, including those who may have worked on salary determination matters for a number of years. We believe that a good salary survey requires that a salary review be made of the rates that are being paid for comparable work in your community; that is, your area of competition for good employees. We call this an external comparison. It is a good practice to obtain current salary surveys that have been made by larger governmental jurisdictions in your area, as you can often tailor your salary plan after theirs. Another important factor in salary determination is internal comparisons; that is, you must have a reasonable internal relationship in your own agency.

After a salary plan is established, you are then confronted with the task of continuous administration of such a plan, and this is the time when a firm policy needs to be established. Most governmental jurisdictions have established what we call the five step plan. Normally the difference between the steps is about 5%. A new employee is normally employed at the first step. A typical advancement pattern is for the person to advance to the second step, in other words a five per cent increase at the conclusion of six months, and then to increase one step each year thereafter until he reaches his fifth step. When operating under such a plan, you can be expected to be requested to employ people above the beginning step because of their unusual ability or experience. Occasionally it is necessary and desirable to start above the first step to obtain people of outstanding ability. However, each request must be screened most carefully, as every exception to beginning at the first step must be well substantiated or you will soon see your salary plan undergoing destruction.

Recruiting and the final selection of employees in your organization is probably one of the most difficult and most important decisions that you make. If you surround yourself with capable people you have made substantial strides toward having a good organization. It is important that you know good recruiting sources in your community. We have found that very effective recruiting can be carried on at the local level by submitting articles to the newspapers and to the television and radio companies. It is desirable that you use an interview board to select the people to fill your most responsible positions. The interview board approach adds prestige, especially when you are recruiting from outside your community, and assists in assuring the applicant that the selection will be based upon what a person knows and not who he knows. A good interview board should consist of the appointing authority, a person who is technically well qualified in the field, and many times it is good public relations to ask one of the leaders in your community to sit on the board.

There are certain basic personnel policies that should be written so that there is a clear understanding of all concerned. The first of these is vacation. We have found that it works best to place your vacation leave on a working day basis. It is normal to require a new employee to work either six months or a year prior to being eligible to take vacation. For instance, if it is typical in your community for employees to get two

weeks vacation, you then would allow ten working days. It is also believed desirable to allow some accumulation of vacation. However, I do not think it should ever exceed a two year accumulation. For instance, if you were to allow 10 working days per year, your maximum accumulation would be 20 working days.

Sick leave is provided by most governmental and private agencies today. Sick leave plans vary greatly. However, the most typical one found in governmental agencies consists of an accumulation of one working day of each month of employment. Many agencies place a restriction on the total amount of sick leave that can be accumulated. We believe that this is undesirable. It is believed that the long term employee should be protected, and by not having a restriction on accumulated sick leave you are normally in a position to provide the necessary protection. Sick leave, of course, is always subject to abuse, if it is not closely administered and controlled. The typical abusers are those who never allow it to accumulate. There are many ways of attempting to control this abuse, and the most effective one is to require the employee to have a physical examination to see if he should continue with his employment.

Most personnel programs provide for leaves of absence without pay under certain conditions. We believe that the period of time of such leaves should be restricted and should not exceed thirty days except for extended illness or further education. When a person is on a leave of absence from a position, it is always difficult to fill it with a competent person.

The number of holidays that are provided should be written into your personnel policies. Most governmental agencies follow the so-called "political code holidays" that are specified in the State Government Code.

It is believed most important that a good physical examination be given prior to the person's employment. A good physical examination protects the employee as well as your agency. The use of sick leave time and the possibility of Industrial Accident Compensation resulting from aggravation of a previous physical condition is a real cost to your district.

In summary, I should like to review with you the points we have been discussing. We have stated that a good classification plan is basic to a good personnel program. In discussing salary matters, we pointed out the need to keep your salary rates current through checking the going rates in your community. In administering the salary plan, it is important that you stick to the policies and not make a lot of exceptions unless they are substantiated. Recruiting is important. Good recruiting means good employees. There are certain personnel policies that should be written so that all concerned are familiar with them. This would include your vacations, sick leave, leaves of absence, and holidays. A good physical examination should be required for all new employees. Such an examination is of real benefit, not only to your district, but to your employees as well.

I have enjoyed so very much spending this time with you discussing personnel policies, and I shall be glad to attempt to answer any questions you might have.

Mr. McFarland: What do you recommend as to the policy in the five step plan? Do you give automatic raises, or use some kind of a merit raise plan?

Mr. McCauley: I am going to suggest to you what is desirable and then I am going to have to be honest and tell you what is practical. It is desirable and theoretically possible to move employees from a lower step to a higher one based upon merit rather than on time in the step. It is frequently suggested that on a five step plan the 4th and 5th steps be reserved for those employees who are unusually well qualified. Private industry has been reasonably successful in administering a merit advancement type of policy. Several governmental agencies have conscientiously tried to work on a merit advancement plan, and I know of no agency that has been successful in administering such a plan. The reason private industry has been able to work out a merit advancement plan and government has not seems to me to be based upon the fact that in private industry the salaried employees' rates of pay are considered to be confidential information, and no one knows what the other person makes except the boss and possibly his bookkeeper. If the bookkeeper should be indiscreet and not keep the information confidential, she probably would be looking for a new position. In government, as you well know, all salaries are public information and anyone has a right to know what the government employee is making. The result is that when a public employee is not advanced to the 4th or 5th step everybody knows about it. He feels badly of course that he is not getting more money, but he feels even worse because he knows that everybody else knows that he is not considered capable of moving to the 4th or 5th step.

I am very familiar with one public jurisdiction which tried very conscientiously to administer a merit plan for the 4th and 5th steps, and it simply didn't work.

I am not sure that this has been a good answer, but some practical experience has led me to the above conclusions.

Mr. McFarland: What is the thinking of men in government in this area of fringe benefits? Do government employees get more fringe benefits than employees in private industry?

Mr. McCauley: This is a very good question, and it is one that has been subjected to a good bit of research in very recent years. Some twenty to thirty years ago there was no question but what the person in public service received a number of fringe benefits that were not available to the typical worker in private industry. Since World War II we have seen a tremendous change in that private industry is granting greater fringe benefits and recent studies indicate that many of the large stable industrial concerns are now granting fringe benefits that are equal and in many instances exceed those to be found in a typical governmental jurisdiction. I know we have all heard time and again that you can pay public employees less because of all of the fringe benefits that are available to them. This is no longer true according to the more recent studies that have been made on this subject.

Question: Do your employees come under civil service, that is, do they have to take examinations?

Mr. McCauley: In Monterey County we do not have a civil service law. Most of the cities and counties in the State of California which are similar in size to our county do have civil service. Monterey County has been most fortunate to have a very stable type of government and employees have been hired and fired be-

cause of what they can do and not who they know. The result has been that there has never been any strong desire upon the part of the employees themselves to have a civil service law.

Prior to coming to Monterey County I had considerable experience in assisting in the administering of a strong civil service law. It is my belief that as long as employees are hired and dismissed because of their ability or lack of ability to do a job we are better off without a restrictive civil service law which is to be found in so many governmental jurisdictions.

Mr. Gray: I might point out that along about thirty or forty years ago the things that you now term governmental benefits were then termed graft.

Mr. McCauley: I have heard it put that way. While we are talking about fringe benefits, perhaps we should mention another type of fringe benefits which has received a considerable amount of attention throughout the State of California at this time. This is in regard to the jurisdiction paying part or all of an employee's health insurance. During the past five years there has been a rapid increase in the number of jurisdictions that are paying a portion of the cost. The typical amount seems to be from $3 to $5 per month. It has been possible for those jurisdictions that pay a part of the employee's health insurance to obtain a substantially better contract than could be obtained otherwise. The insurance companies are able to write a better plan where there is employer participation because they are able to get close to 100% coverage, thus making it possible for them to spread their risk.

Are there any other questions? I do not want to take too long. In closing I would like to tell you how much I have enjoyed talking to you these few minutes. I hope you will find your stay on the Monterey Peninsula both profitable and enjoyable and I am sure you will.

PUBLIC EDUCATION AND PUBLIC RELATIONS FROM A NEWSMAN'S POINT OF VIEW

W. R. Paxton
Regional Public Relations Representative
Standard Oil Company of California

Thank you, Mr. Chairman. When Howard Greenfield and I discussed this subject, it was already set in this program, and the title was "Public Education and Public Relations from a Newsman's Point of View." That left the field wide open, believe me. Now I am wearing two hats today, so I am going to presume upon your indulgence and speak first upon public relations, and why I think it is important to any organized group, especially public servants, who are supported by tax revenues of different kinds, in this day and age particularly.

I saw in the press the other day that Governor Brown is reducing by, what, five million dollars? the appropriation to mosquito control. That probably gets the conference off to a jolly note, I am sure. Somewhere along the line, maybe there hasn't been enough public relations with the right people. I don't know.

There are all kinds of definitions as to what public relations is. The one that I like, and because it is short, probably, is "Find out what people like; do more of it. Find out what they don't like; quit doing it. And, tell about it." Now, that "tell about it" is important; and your own group is an illustration. I dropped in at the Monterey Herald this morning to see the Managing Editor, who is a good friend of mine, not because I hoped a reporter would be here to listen to my deathless words of wisdom, because I have none to give you—I'll be frank. But I checked the paper Friday and Saturday to see just what advance news there had been on the Conference. He was sure there had been something. So we took the Saturday paper apart, bit by bit, and sure enough, on the bottom of page two, a little five line notice. "Some two hundred members of the State Mosquito Control Association will be at the Mark Thomas Monday, Tuesday and Wednesday," period. End of story. Then to add insult to injury—I hope I am not embarrassing your Publicity Chairman, because that isn't my intention—I said, "Do you know what's on the agenda? Do you know what's on the program for these three days." Nope. Well, it just so happened that I had one in my grimy little paw, as I laid it on his desk and said "Here, in case you are interested." He said, "Thanks. I am." So possibly, you folks may get sometime during these three days a little local publicity. I am very happy if you do. That is a little extra gratuitous contribution on my part.

Now the basic function of public relations, I hope that you will agree with me, is to build good will through understanding. In the process of doing that, you will use—and we do all the time—three main channels of communication that are as old as man. The first is informing people; the second is persuading people; and the third is integrating with people.

Each of these three channels of communication which I mentioned, depend upon man's ability to communicate—and here we have a little cycle. Before we get busy communicating, may I suggest that the number one public relations problem in any group is to decide upon what are your problems within your organization. Do you have internal problems of communication that need solving as soon as possible? Do you have external problems as well? Now, when you do that, don't forget to consider this one point that I think is important. Familiarity and reputation are two different things. People may know all about mosquito abatement, but what they think about it is something else again. And that may not necessarily be good.

Secondly, when you begin any job of communications, you have to consider the question of "is your house in order." Do you have management support with what you are doing? Do you have a teamwork spirit which you are going to interpret, because communications only tells a story. It presents; it interpets; but, it doesn't create. The powers that be have to take care of that angle for you.

The third decision along the line that has to be taken care of by someone before you can do an effective job seems to be to determine what are your goals. What do you want to do? What public reactions are you after? Whom do you want to reach? How do you plan to

reach these goals with these audiences? You can use various media of communications as tools. Of course, you have the shotgun technique; you have the pinpoint or the rifle technique. One example of the shotgun technique which registered with me because it relates to you people. Here, somebody missed the boat, I think. Do you remember the wire story that the Associated Press carried a year or so ago? A report on the gradual increase of malaria in the United States? I think that there was a three or four column map shaded to show the States where they had found malaria mosquitoes. As I recall, there was a spot in southern California; that may be wrong. But the reason that it triggered me as a newsman, as well as a public relations man, it was the perfect type of story for some local or State person in California, concerned with public health to come up with a statement as to what is the situation here—Orange County, San Burdue, in the State of California or what not. There was nothing released to my knowledge. I think somebody missed a bet there. I think a lot of City Editors and newspapers missed a bet there, too. But there is a little excuse for them doing it and possibly none for you as a professional organization. They have a lot of places to cover and a lot of things to do.

When we start talking about City Editors, I take off the P.R. hat for a moment, put it down, and now it's the newsman speaking, to try and give you what possibly his attitude may be towards public relations. Actually, what I am trying to do—and here again is to have a little a, b, c session in some basic fundamentals of reporting. It may possibly help you. I am quite sure that in your experience, you have possibly sent in to the newspapers what you were sure was just the essence of a tremendous news release and it laid a big fat egg. There are differences in news stories, there are differences in editors, and certainly there is a lot of difference between a P.R. man and a newspaper man, etc.

I promise you that the City Press is interested in what you do. But don't forget, the City Editor, or almost any editorial man on a newspaper, is faced with several problems. First of all, they are pressed for time. It is amazing how frequently, or often, the deadline rolls around when the newsman sits there with sixty inches, eighty inches, twenty columns of space that he has to fill with news somehow. When somebody comes in and says, Jim, here is a story about something, and he has some confidence in you through previous experience, you suddenly have wings and a gold halo around your head and the red carpet is rolled out and there is soft music playing in the distance because you have helped him out of a tough spot.

Number two, like everybody else, Parkinson's Law doesn't seem to work in newspaper offices. Newspapers are traditionally shorthanded. They can't possibly cover all the news stories that exist in towns the size of Monterey, Sacramento or where have you. So, when you report to them the activities of a group of public spirited citizens or an organization such as yours or any other group, you are doing them a favor. You are covering an activity that may have some possible news value for their readers and for the community.

Now, number three. I think this is one that hits all of us, and I am not going to duck the rock, newspaper people are lazy, just like the rest of us. They have no objections to our doing the work for them, nor do they object to you doing it. But, if you note a cynical look on the faces of the editors or some of the newspaper men, it is because somebody along the line has tried to pull a fast one—not one, but several. So they are apt to be gun-shy. It takes a little while to establish a cordial relationship. The moral there is, don't try to fool them. Do a basic reporting job and the odds are eighty per cent in your favor, not necessarily of having it used as you submit it or on the day that you necessarily feel that it should go in, since the news requirements or space requirements of a newspaper will vary. You have noticed lately the pattern, all the big food stores run their ads Wednesday. It used to be Thursday; years ago it was Friday. It's just like Christmas; it used to be, you know, that it wasn't until the first of December that the Christmas trees used to go up and that Santa Claus appeared in the department stores. Then it was the week after Thanksgiving, and now, last year, it was the first of November. I am thinking that any day now, once the Fourth of July is out of the way, the street decorations are going up. The press has the same problems.

Item four is a cliché, yet it is basically true. That is, that names make news. Surprisingly, names are still the foundations upon which all news is built. Your own group here is made of people with names of people from towns, from different organizations with different activities. Somewhere in this group, sometime within these days, somebody is going to make a statement or a report that, properly handled, would probably make the wire services and be reprinted coast to coast. Maybe not. But don't forget to use names.

One of the favorite gags around the press room in Oakland City Hall is that every time Dr. Geiger gets a new decoration he comes down so the boys can take a picture and talk about it, and he gets his name in the papers. He has sixty-eight or seventy-three; something like that. Then, when he wrote his new book last fall, we had a press party on that—more publicity. Actually, I am not a professional man. I don't read your literature. I don't have the slightest idea what contributions Dr. Geiger has made to public health; but, do you know any body in public health that has more decorations than he does? I don't think he has a paid public relations man working for him.

Let's review this now, not the four basic points, but what happens when you go to any news media with a story or a picture about your activities. First of all, you are serving your own organization by publicizing the members, their activities, and the contributions they make to the common good. Secondly, you are doing that particular news media a favor by supplying them, or making news available to them that they might have missed. Third, you are helping the audiences of these different news media by writing news about their fellow citizens. Do it well, and all these people to whom you take these releases will thank you. If you do it badly—well, let's not go into that. Let's be charitable.

Now we get more into the fundamentals of what is a news release that makes some sense to a news editor, and what do you have to start with. I hope that I am not insulting anyone's intelligence by doing this, because you people have your own methods of procedure, your own methods of communication. You profes-

sional people with PhD's after your names—I doubt very much if you would use a monosyllabic word if you could because, after all, there is a certain amount of prestige that goes with that, and polysyllabic words express those. The press goes just the other way. They take the attitude—except some specialized feature writers—that every reader has just about the ability to spell out c-a-t, with errors. So the stories are pretty much down to that level, but then I am ahead of myself as is usual.

Above all, you need a typewriter. Never submit a story, unless it is just absolutely impossible to do anything else, in longhand. Two: good white, plain paper. Not colored paper; not ruled paper; just plain white paper and not tissue. Tissue is a second copy, flimsy; you keep that for your carbon. Double-space all the news part of it. Pull your margins in at least an inch and a half from each side so that any notes to the typographer can go in there. You drop the story down at least a third from the top, on the front page, so that they can put in directions as to the type to set, write a head in there or a cap, with the type on that. At the top of the left corner, you type in caps, first, the name of the organization; second, the name of the man or woman who has written the news release; third, the address; fourth, the phone number. That is for obvious reasons; if they want to do any checking on that story there has to be one person that is a clearing house. If you are the one, you should be available at that number if there is any possibility that there will be a follow-up on it. In connection with that, when you put names and things in a news release, be sure they are spelled properly, be sure that they have a title that makes sense, that they have the address and other pertinent information about that person so that the desk won't have to call back and say, "Who he? Why is he in here," and so forth.

3. Carbon paper. Always keep at least one copy of any news release you send in. You would be surprised at what typesetters can do to copy, and you'd be surprised at how proofreaders can miss the mistakes when they are sitting there with the original copy of your story there in front of them. Sometimes it has most embarrassing repercussions, even to the point of lawsuits. If you sit there with the carbon in your files, your attorney will love you, even if no one else will.

4. Stamps and envelopes, if you mail your stories in. Never send anything in postage due. Isn't that a silly statement. Of course you would never think of it; yet you would be surprised at people who feel they are doing the paper a favor or some other organization a favor by so doing—no stamp on it.

You, yourself, if you are serving as the reporter for your group, should have always available a list of the key people in your organization, their titles, their addresses, their phone numbers, possibly a little biographical background on them, if your organization is large enough and these people are important enough. If you just happen to have an 8x10 glossy photograph tucked in the file too, so much the better. You should be surprised how many times they would be used. Now it may be reduced to one column by 1½ inch cut, but still a picture in the paper, no matter how small, certainly is better than nothing at all. Unfortunately, the days of Barnum are gone. You remember he is supposed to have said, "I don't care what you say about me, just so you spell my name right." People are a little more sensitive today. So, I toss that in for good measure also.

Then, certainly, you want to have in your files, a list of the editors, the reporters, the feature writers, the special feature writers with whom you are going to be working, their day and night phone and what not. Then, as a followup to that, naturally, if you have a little time, develop a personal acquaintanceship with these people. It is amazing what it will do sometimes towards getting a little news release in, or not getting it in. Maybe you don't care about getting publicity. Maybe you'd rather not have it; if so, then you can forget about these things.

A dictionary is a desirable part of every reporter's library, in fact, a dictionary and a good grammar. We put out quarterly reports to our stockholders. We put out about 185,000 of them every quarter. The last one came out and it dealt for three pages with the Company's aid to education, how we spent about two million dollars last year making the schools better or what have you. One of our stockholders also happens to be City Editor of the Berkeley Gazette. I got a nice letter about a week after the report came out. He said as a stockholder he was delighted to know what the company was doing. As a citizen he was very grateful for the contributions we were making to education. Then he went on to say, or ask, if it would be presuming too much though to ask that our public relations department spend a dollar and ninety-five cents for a copy of Fowler's Modern American Grammar, because he said there were three of the most beautiful split infinitives in that report that he had ever read. So—sometimes you have a critical audience.

Actually, the last point is the most important of all with any type of news. That is imagination and originality. They are the priceless ingredients. You have heard in Kipling's poem:

I kept six honest serving men,
They taught me all I know.
Their names were who and what and why . . . etc.

Those are still important. That news release about your activity that ran in the Herald Saturday night undoubtedly had three or four more paragraphs tacked to it, but they were tight for space so they took the first paragraph which contained the basic ingredients. It had the who; it had the what; it didn't have the how in there because there was no need for how in that particular deal. You should do that too, because it is surprising how many City Editors or copy-desk people never get beyond that first paragraph. You would be surprised too, how often that first paragraph will be printed whereas two or three paragraphs won't. They will not rewrite the whole thing; they may take out a line; they may take out a word, if they have a particular taboo, but that's it.

Now in this originality or imagination gimmick, let's suggest two leads in the story and let you choose which one you think has a little more imagination.

1. John Jones, Vice-President of the American Amalgamated Cheese Company spoke last night before the Berkeley boop-de-doos on so forth and so on.

2. "How Safe Is Your Life?" John Jones, Vice-President of the National Safety Council, asked the State Mosquito Control Association yesterday at the Mark

Thomas Inn. "Not a plugged penny's more than your driving makes it," he said.

Doesn't that "How Safe Is Your Life?" have more impact to you? I remember, in some reports that came from Clear Lake after the first great experiment. They killed the larvae and next spring there were no new larvae. I saw all kinds of headlines on the story—it ran around the bay on that—but the one that still stands out in my mind, is the one that said "Gnats are gone at Clear Lake" period. That said everything that had to be said. Then it went on to quote the entomologist and so forth. When I contrasted that with the story in the Napa Register which said, "A three week survey of Clear Lake waters by so and so indicates no larvae" . . . and away we go. Which of the two there do you think has the more value to a newsman, to an editor, who is going to look for something that is going to catch his readers' eye? Do you prefer the one that I do: "The Gnats are gone at Clear Lake?"

All stories can't work out that way, but I saw one not long ago that was on a civil war veteran that had died. There were two treatments in the Bay press. One ran like this: "One hundred years of American History passed away last night at the Masonic Home." Another said that John so forth and so on, civil war veteran, died last night. He was 102 years old. See the difference there? That is good reporting, if you can do it. Of course I don't know how in the devil you are going to get that tomorrow on a story say, a report, on the Clear Lake Gnat or the Valley Black Gnat deal, or what have you, unless you have a dramatic announcement to make that we have licked them.

This competition for news space is just that. It's competition; it's *tough* competition; and the people who are competing for the space are getting smarter and smarter as to the timing of things, the handling of stories, the way they use photographs . . . So, that puts you on the spot to be equally as smart, or as tricky or as imaginative, or whatever as they are. I am convinced that you can do it, you have a tremendous story to tell. Believe me, every time I sit out in my backyard in the evening and don't have to snap at mosquitoes . . . We haven't had screens on our house in Berkeley in ten years; no flies, until we got a dog. Then we got rid of the dog; so no flies again. But those things are invaluable. Are you telling your story in terms of the pleasure of the outdoor barbecues and the many other things that you and others like you have made possible? I don't know whether you are or not, but believe me, if you got down to a battle for funds somewhere and you put it up to the outdoor barbecue boys: Well, do you want mosquitoes around when you broil hamburger or don't you? Howard, here, was telling me that your motto is, "if you can't drain it, fill it"; you might build your story around that.

You can get your share if you try. How well you do is up to you. I am going to be interested in watching for what comes out here in the next two or three days. What kind of a press do you get. The efforts pay off.

You acquire reputations in funny ways and there are all kinds of stories evolve around those . . . You remember the era of the Model T and the Ford jokes. Ford literally hired gagsters that worked up those jokes and gave them to vaudevillians to get them out. It was smart; it publicized the Model T like nothing else did. My Company now and then gets in a story. There is one that I have always loved, maybe it has a moral in it or not, but I would like to tell it to you in closing. That is about anyone you might want to pick, but someone has a nice new car and is driving down the street and they have a long length of chain tied to the rear end. A fellow on the curb sees his friend and hails him over and says, "How come that long chain on the new car? It doesn't go with it." The answer comes back, "I don't really know, but I notice that every Standard Oil Truck has one, and if they do it, there's money in it."

Thank you very much.

Pres. Portman: Thank you very much, Mr. Paxton. There will be a slight delay while Tom McGowan is setting up his equipment. Most of you may know Tom McGowan; he has been with the City of San Jose and then he was on an ICA assignment in India to survey control measures for filariasis.

NOTE: Dr. Thomas F. McGowan presented colored slides and narrative on his travels in India. At 6:30 p.m. that evening a hospitality hour was provided by the Association, followed by a banquet. Mr. Harold F. Gray was Master of Ceremonies after the banquet, and Dr. William C. Reeves started an interesting travelogue with colored slides before equipment failure unfortunately curtailed his presentation.

THIRD SESSION

TUESDAY, FEBRUARY 3, 1959, 8:30 A.M.

ANNUAL BUSINESS MEETING OF THE CALIFORNIA MOSQUITO CONTROL ASSOCIATION

PRESIDENTIAL ADDRESS

ROBERT F. PORTMAN
President, California Mosquito Control Association, Inc.

Mosquito control in California which started about 1903 has in recent years experienced extensive growth, change and advancement, so that today a large segment of California's population benefits from the efforts on their behalf by forty-eight mosquito abatement districts, one pest abatement district and five health departments.

On December 16, 1930, representatives of some fourteen mosquito abatement districts, and interested individuals, in response to an invitation by Harold Gray, met informally at the University of California to discuss their problems of mosquito control. Desiring to continue these meetings, officers were elected. This was the Association's first annual conference. Since that time, except during the war years of 1942 and 1943, conferences have been held every year.

Limited by insecticides, equipment, finances, and relatively little demand by the public, mosquito control in California expanded and advanced slowly prior to World War II. Then immediately after the war, which brought about the removal of these deterrents and made available more trained individuals interested in this work, California's mosquito control gained the impetus which has brought it to where it is today.

During the last twelve years since World War II, there have been many advancements in knowledge, materials, equipment and personnel as well as considerable expansion of the area under control. Such rapid progress and expansion is always accompanied by trials and tribulations. And, as is to be expected, this Association has also been confronted with these same and similar trials and tribulations, but it has grown up and matured to be at least one of the most outstanding mosquito control associations in the world. Perhaps you think it is the best, I do.

During the past year, your regional representatives have really functioned. They have tried to obtain your ideas and desires and have presented them impartially at the Board of Directors meetings where the welfare of the individual mosquito control agency as well as the overall welfare of mosquito control in California has been carefully considered before decisions were made. Your committees have likewise worked for the benefit of the individual as well as the whole.

Accomplishments have been made; they may not be monumental, but I sincerely hope that this evolutionary change which has come to pass in the functioning of this Association's Board of Directors and Committees will not only continue but also continue to improve. I cannot wish a more rewarding or a more responsible task upon your new officers and representatives.

Pres. Portman: I would like to mention that there has been planned a field trip to the Northern Salinas Valley Mosquito Abatement District. Those planning on attending should meet at this time out in the lobby.

I would, at this time, like to thank Tom McGowan for showing his slides last night. Although I was tied up in a Board of Directors meeting and could not attend, I want to express my appreciation, especially since he did this on the spur of the moment. I would also like to say what I can to make Bill Reeves feel better, because due to mechanical difficulties beyond our control, which everybody experienced last night, we could not see and hear Bill's travelog. But we will be getting him again very soon.

We now wish to have reports from the various Association committees. We will appreciate it very much if the reports are brief and concise, as we are already a half-hour late this morning.

I am not going to call on the Committees in order. In response to a request, I am going to call on the Entomology Committee, Chairman Leon Hall.

1958 ENTOMOLOGY COMMITTEE REPORT

The 1958 Committee was enlarged from eight to twelve members. This group held a total of five meetings during the year.

The first meeting was called to formulate the final plans for the 2nd Annual Entomology Seminar, which was held at Fresno State College Campus. This meeting proved very successful with a total of forty-eight in attendance. This distinguished group included managers, entomologists, and technically trained men from USPHS, BVC, U.S. Navy, and various universities of the State.

The subjects discussed were led by a qualified moderator who gave a brief introduction to stimulate the group. A dinner meeting was held in the evening with an interesting after-dinner speaker. The site for the 1959 meeting selected by the group was Riverside, California. Riverside offers an excellent opportunity to visit the nearby research facilities and discuss insecticide problems.

A review of the Fresno Seminar was published in the June issue of Mosquito News.

One of the highlights of the 1958 Committee's work was the completion of the "Field Guide to the Common Mosquitoes of California." This Guide has been in progress for the past three years, and various phases such as adult and larval keys, illustrations, common names, and ecological data of common species represent a great deal of effort by the various members. The objective was to present a key of non-technical nature

to be used by the field personnel engaged in mosquito control.

This Guide was reviewed by the CMCA Publications Committee and the Bureau of Vector Control Identification Unit. Work is now in progress for final publication and should be available for this Conference.

The Committee completed the survey of mosquito control workers to obtain new and useful information concerning the biology and ecology of several of our California mosquito species. This information was sent to the Bureau of Vector Control in Berkeley to be located in the Identification Unit.

Projects that are now in progress by the Committee are: The Gathering of Information on Mosquito-like Insects—midges, gnats, etc.—with the idea of developing a pamphlet for public education. An effort is being made by the Committee to evaluate measurement studies, and it was agreed that standardization is the key factor when comparisons are to be made. In the future, perhaps the Committee could set up recommendations and/or standards for body counts, larval dipping, net sweeps, etc. Qualifications and duties of Entomologists engaged in mosquito control work in California are also being set up.

The Committee would like to extend thanks to all those who have contributed to the various projects of the Committee, including facilities and data—with special thanks to Jack Shanafelt for the time and use of his facilities to publish our Field Guide.

Respectfully submitted,

L. L. Hall, *Chairman*
C.M.C.A. Entomology Committee

Dr. Richard Bohart, U.C. at Davis

Dr. E. C. Loomis, B.V.C.

Harry Mathis, Marin Co. M.A.D.

John Manweiller, Delano M.A.D.

Embree Mezger, Solano Co. M.A.D.

Tom Lauret, San Mateo Co. M.A.D.

Herbert Herms, Sutter-Yuba M.A.D.

Richard Frolli, Corcoran M.A.D.

Dean Ecke, Santa Clara Co. Health Dept.

Jack Fowler, Sacramento-Yolo Co. M.A.D.

Merrill Wood, No. Salinas Valley M.A.D.

BUDGET COMMITTEE REPORT

Shortly after the 26th Conference, the President appointed this budget committee to prepare a budget and fiscal recommendations for the current (1958) fiscal year. You will remember that at the 26th Conference a budget report was made; however, it met with serious objections by several, so that finally no action was taken at that time.

This is to report that this committee has tried, on several occasions and by correspondence, to develop a budget and other fiscal recommendations. We soon discovered that our several opinions on the matter were very divergent. We had reached an impasse and recommended to the Board of Directors at their meeting of January 8, 1959, that the members of this committee be discharged and that the 1959 Board of Directors appoint a new Budget Committee composed of the Regional Representatives. This procedure was approved and awaits the action by the new Board of Directors.

Respectfully,

G. EDWIN WASHBURN

JACK H. KIMBALL

C. DONALD GRANT

DAIRY WASTE STUDY COMMITTEE REPORT

The dairy waste study committee had one meeting in Fresno at which time a program of study and investigation was formulated. Since this March, 1958 meeting, the study has continued; however, no complete report is as yet available.

Briefly the following study program is in progress:

1. Investigation of current disposal practices by use of especially laid out furrows, use of dairy waste in routine irrigation and use of retention ponds.
2. Survey of scope and methods of sewering of dairies to domestic sewers.
   a. Structures used and required.
   b. Sludge problems.
3. Storm water and flood control channel problems.
4. Legal aspects of dairy waste disposal.
   a. Agricultural Code.
   b. Health and Safety Code.
   c. Railroad Act.
   d. Local ordinances—city, county and district.
   e. Recommended legislation.
5. Suitable larvicide and pupicide materials for dairy waste.
6. Vegetation control in dairy waste disposal areas.
7. Attitudes of dairymen, their associated groups and other interested parties such as dairy inspectors.

It is recommended that this study be continued.

Dairy Waste Study Committee

Gardner C. McFarland, Chm.,
Southeast M.A.D.

Robert Peters,
Northern San Joaquin M.A.D.

G. F. Augustson,
Madera County M.A.D.

Pres. Portman: We will now hear the Duck Club Committee's report. Arthur Geib, Kern Mosquito Abatement District.

Mr. Geib: No ducks, no mosquitoes, no report.

Pres. Portman: Thank you, Art. We made up a little time there. We will hear the Education and Publicity Committee's report.

EDUCATION AND PUBLICITY COMMITTEE

The Education and Publicity Committee's projects for 1958 were:

(1) To prepare an irrigated pasture bulletin.
(2) Plan an administrative school for mosquito abatement agencies.

The pasture bulletin project was not completed due to the changes in committee personnel, and another year will be needed to complete this publication.

Investigations were made and plans were developed for an administrative school for mosquito control agencies, and arrangements have been completed for this managers' institute on October 20, 21st and 22nd, 1959 at Monterey, California. This three day meeting will be conducted by the University of California, California Agricultural Extension Service, State Department of Public Health, and the California Mosquito Control Association. The objectives of this meeting will be:

(a) To present information from recognized leaders in the field of administrative principles and practices.
(b) To provide participants with opportunity to relate this information to "on-the-job-problems."
(c) To increase the administrative capabilities and insight of participants.

Within the next thirty days the program and schedules of the meeting will be completed and mailed to the Association members by April 1st. It is the hope of this committee that each manager and his assistant will attend this managers' institute.

Recommendations:

In reviewing the past year's activities, this committee would like to make the following recommendations:

(1) Retain at least two members from the 1958 Committee.
(2) Complete arrangements for the publication of an irrigated pasture bulletin.
(3) Complete arrangements for the managers' institute at Monterey in October, 1959.

Respectfully submitted,

L. R. Brumbaugh, Chairman

Robert Peters

Howard Dunphy

John Stivers

Eric Yeoman

Pres. Portman: Thank you, Les. We will now hear the Forms, Records and Statistics Committee's report. Jack Shannafelt, Committee Chairman, isn't here? Is someone here from the Insecticides and Herbicides Committee? Then we will go on and have a report from the Insurance Committee.

Mr. Smith: There is no formal report and the action of the Committee has been presented in the talk given yesterday by Mr. Juiffre.

Pres. Portmans Thanks, Gordie. Is Don Murray in the room? Don, can you give the report of the Forms, Records and Statistics Committee.

FORMS, RECORDS AND STATISTICS COMMITTEE

I am totally unprepared. In 1959, for the first time in three years, we did not prepare a yearbook. There was some doubt as to whether it should be continued to be put out each year. Recommendations from this Association would be appreciated on that. We did prepare the Annual Salary Schedule, working conditions for the Association, which was submitted to all of the Districts.

Submitted by:
Dr. W. Donald Murray, Member

Pres. Portman: Now we would like to hear from Gardner McFarland concerning the work done by the Legislative Committee.

Ted Raley: From the Consolidated Mosquito Abatement District. I was wondering if this was the time that you wanted to take some action on that suggestion as to whether a year book should be prepared each year, or whether you would rather take that up later in the discussion.

Pres. Portman: Perhaps it would be a good idea to take that up at this time. Do you wish to discuss this matter now?

Mr. Raley: I would like to speak in favor of the annual publication of the Year Book for the Association. I feel it is a valuable record for the group itself, and I get countless requests for information from other parts of the country, and it has been an excellent publication for not only satisfying the queries coming to my office so that I have something to make my reply look good, but it does give California, I think, a lot of publicity not only throughout this country but throughout the world. I would like to see the Year Book published annually.

Pres. Portman: All right. I will call now for any adverse comments to this, if anyone has any. Are there any adverse comments or discussions at this time? It doesn't seem like there are any. Does the group as a whole wish the continuation of this work?

Dr. Murray: I would like to recommend that your incoming Board of Directors make it a point to arrange that with your incoming Chairman of the Forms, Records and Statistics Committee for next year.

Pres. Portman: The recommendation is accepted by the chair. I almost went past you Gardner, will you give your Committee's report now?

Mr. McFarland: Practically the most important committee of the Association was by-passed. You all have

a copy of our report and I think it is rather complete. I think you can see that the Committee has worked very hard, and I would like to thank the members for all the work they did—attending meetings, in correspondence, and so on. This is a committee that has to work pretty hard during the year, especially a legislative year like this one. I want to especially thank Chester Robinson, who was the Chairman last year, and he did good service. We have carried out the wishes, we feel, of the Association. We received considerable correspondence. I have a file here of several hundred pages while we were trying to agree on various legislative improvements of the Health and Safety Code. As you all know, I think it was the Senate Interim Committee that was studying the legislative needs of all the districts and has sent out letters to you. This Committee made a recommendation, in fact prepared a letter in the name of the Association that was approved by the Board of Directors, and sent to the Senate Interim Committee.

1958 LEGISLATIVE COMMITTEE REPORT

The Legislative Committee of the California Mosquito Control Association met twice during 1958 as a committee and with the Board of Directors for advice and recommendations. Five legislative bills evolved which seem to reflect in a large part the recommendations of the membership of the CMCA. Care has been taken not to disturb the sound, workable provisions of the Health and Saefty Code relating to mosquito control. All amendments provide for technical improvements which will help clarify certain ambiguities and make the mission of adequate mosquito control easier to accomplish. A program of this type means better service, more effectively carried out at lowest possible cost to the taxpayers.

We are fortunate in having the cooperation of members of the legislature for introduction of the legislation. Carley V. Porter, Assemblyman, 69th District, Los Angeles County, has been very helpful in providing the services of the legislative counsel and is spearheading introduction of the Bill in the Assembly. Assemblymen who have indicated that they are agreeable to cosponsor include: Walter Dahl, 16th District, Alameda County; William Biddick, Jr., 12th District, San Joaquin County; George Willson, 52nd District and Ronald Cameron, 51st District, Los Angeles County.

Senator Alan Short of San Joaquin County, has agreed to introduce the Bills in the Senate.

Summaries of Proposed Amendments:

The act to amend *Section 2206* of the Health and Safety Code, (Req. #4309) 10/29/58, has been approved by the Legislature for about the last ten sessions. This law is obsolete and the cost under it is prohibitive for the formation of a district since the alternate method of forming a district by resolution of the Board of Supervisors has been used during this time.

The act to amend *Sections 2248 and 2851* of the H. & S. Code (Req. #4309) 11/3/58, is permissive legislation to allow members of Boards of Trustees up to a maximum of $25.00 per month in lieu of travel expenses instead of $10.00 per month. It is felt that this amount would more reasonably compensate trustees for current increased costs of transportation and expenses.

The act to amend *Section 2312*, H. & S. Code (Req. #4309) 10/29/58, is being presented because often the President and Secretary of Boards of Trustees of Mosquito Abatement Districts live in cities twenty or thirty miles from the main office of the District, which sometimes involves half a day or more getting their signatures. This amendment will authorize the principal administrative officer (Manager) of the District and a member of the Board of Trustees to sign warrants. These warrants are all countersigned by the County Auditor. County Auditors contacted see no objection to this Bill.

The act to amend *Section 2330* and to add *Section 2333.6* to, the H. & S. Code (Req. #4309) 11/3/58, is presented since, under the present interpretation of the law, annexation to a district must be contiguous territory. There are several cases, particularly where "Shoe string strips" exist which prevent cities or unincorporated areas across from these "strips" from annexing to existing mosquito abatement districts. Annexation to an existing district is often desirable since costs for the annexed area would be much less than if the area in question attempted to do their own control.

Section 2333.6 is desired since it provides an additional method for unincorporated territory to annex to a district which is by Resolution of a County Board of Supervisors. City Councils already have the right to annex cities by resolution to mosquito abatement districts so no new precedent is being established. The additional method will help to reflect the wishes of an area to annex to a district without having to go to the expense of the circulation of petitions and other procedures.

The act to amend *Section 2350* and *Section 2351*, H. & S. Code (Req. #3686) 8/11/58, has to do with the concurrence by mosquito abatement district boards on the withdrawal of an area from the district. Any such area is represented by a member on the board, appointed by the City Councils or the Board of Supervisors of the County, so that the member would readily concur with the wishes of the people he represents. The integrity and mission of the district with its component parts would then be adequately protected.

Respectfully submitted,

Gardner C. McFarland, Chairman

E. Chester Robinson

Harold Brydon

Edward D. Davis

Norman F. Hauret

Thomas Sperbeck

Lester R. Brumbaugh

A. S. Glikbarg

Pres. Portman: Thanks, Gardner. And now we will have the report of the Operational Equipment and Procedures Committee.

OPERATIONAL EQUIPMENT AND PROCEDURES COMMITTEE

Bob, we have no formal report; although after this business meeting and we come back from recess, on the program there is that period provided for discussion of that subject matter. Pending the amount of time available, we will get into that if possible; although, hopefully after the recess our main concern is to show the equipment that is here by the districts as well as by the commercial people. So, time will be the factor governing the report of the Operational Equipment and Procedures Committee.

Ted G. Raley, Chairman

PUBLICATIONS COMMITTEE

The Committee was tardy but successful in publication of the 26th Proceedings and Papers of the California Mosquito Control Association. Authorizations by the Board of Directors for recording and transcribing the current Conference Proceedings should relieve some of the problems contributing to previous time delays.

Our attention has been drawn to the inconsistency in pagination of reprints and the Committee should evolve a satisfactory correction of this problem with the printer.

Review and suggestions with a report to the Board of Directors was made by this Committee in regard to the "Field Guide to the Common Mosquitoes of California," as prepared by the Entomology Committee. The Committee also reviewed and edited the legislative amendments submitted by the Legislative Committee.

There are currently no specific recommendations to accompany this report.

Respectfully submitted,

John R. Walker

G. Edwin Washburn

C. Donald Grant, Chairman

RESEARCH COMMITTEE

The needs for research in mosquito control in California were considered by the 1958 Annual Conference of the California Mosquito Control Association. A motion was passed stressing the need for coordination of the various research activities in the vector control field. And further, the State Deparment of Public Health was named as the most logical agency to assume the major responsibilty for this coordination. Also, the incoming president was directed to appoint an ad hoc committee to help in the development of the expanded research program.

This Research Committee was officially created on March 21, 1958.

The first meeting of the Committee was held on April 22. Three projects were defined:

1. Analyze the research needs and determine the preferred course of action.
2. Eliminate the tenuous nature of the present program with its well-known deficiencies, and strive to obtain assured funds and a stable program with adequate equipment and facilities.
3. Compile available information and outline a recommendation of policies for action to be taken by the main body of the CMCA.

An estimate of funds needed to conduct research in various phases of mosquito biology and control was prepared.

A second meeting of the Committee was held on May 22, and the recommendations as developed at that time were presented to the CMCA Board of Directors on May 29.

On June 27 a first draft of a proposed letter to be mailed to the Director of Public Health, Dr. Malcolm Merrill, was circulated among the Committee for editing.

On July 7 the Committee-approved version of this letter was mailed to the CMCA Board of Directors for editing.

On August 26 the Committee, plus other interested members of the CMCA, met with Dr. Merrill and discussed the potential role of the State Department of Public Health in the Research program, including potential methods of financing.

On September 5 a detailed report of this meeting was mailed to all Corporate Members of the CMCA.

On September 19 at the CMCA Board of Directors' meeting in Bakersfield, the proposed method of financing suggested by Dr. Merrill was discussed. It did not meet with general favor.

On October 31 the Committee Chairman was invited to a meeting of the Northern San Joaquin Valley Region of the CMCA, at Stockton. The subject of Research was thoroughly aired, and at the close a resolution was prepared reiterating the stand taken by the CMCA at the Fresno Conferenec and urging that the plans be expedited at the earliest opportunity. It was recommended that a brochure be prepared explaining the needs and plans of the Research Program, this to be sent to all mosquito abatement districts, and to be made available to Legislators and all other interested parties.

On January 8, 1959, at Modesto, at the meeting of the CMCA Board of Directors, certain modifications were made in this Resolution, after which it was passed by the Board of Directors.

Respectfully submitted,

W. Donald Murray, Chairman

Gordon F. Smith

C. Donald Grant

Howard R. Greenfield

Pres. Portman: Is there someone here from the Source Reduction Committee who can give that Committee's report? George Whitten, substituting for John Stivers, who has left our midst to go overseas.

Mr. Whitten: John asked me to take over for him for the rest of this season just before he left.

I would like to suggest that the secretary of the CMCA sign and mail the enclosed letter to Dr. Delbert L. Henderson, thanking him for the time and effort he spent setting up this seminar.

John Stivers, chairman for the Source Reduction Committee, requested that I assume his post as chairman until the CMCA could make proper arrangements.

REPORT OF SOURCE REDUCTION COMMITTEE

The CMCA Source Reduction Committee held an organizational meeting at the Bureau of Vector Control field station, Fresno, on September 25, 1958, followed by an inspection tour of the new Bureau of Vector Control test plots and source reduction projects of the Delta and Kern Mosquito Abatement Districts.

At this meeting it was voted to gather information from member agencies on weed control and source reduction. The questionnaires were sent out and to date twenty-two questionnaires have been returned but the information has not been completely summarized as yet.

The summary will be mailed out to member agencies as soon as completed.

The second meeting of the committee was held at the Merced Mosquito Abatement District on November 11, 1958. A round table discussion developed, which, while it disrupted the planned schedule, was very informative on source reduction problems and weed problems encountered by members.

A tour of source reduction projects by the Merced Mosquito Abatement District was conducted and the planned tour of the San Joaquin and Northern San Joaquin Mosquito Abatement Districts had to be cancelled because of lack of time.

The group embarked for Sacramento for a scheduled two day seminar on source reduction at Davis. The schedule of the seminar is attached to this report.

Respectfully submitted,

George R. Whitten
Chairman, Source Reduction Committee
Pro tem

TENTATIVE SCHEDULE OF CMCA, SOURCE REDUCTION SEMINAR

RECREATION HALL, DAVIS CAMPUS
UNIVERSITY OF CALIFORNIA

WEDNESDAY, NOVEMBER 12, 1958

9:00 A.M.	Registration
10:00 A.M.	Welcome Address— Dr. Stanley Freeborn, Chancellor, U.C. College of Agriculture
10:30 A.M.	Soils, Their Relationship to Irrigation and Drainage — Milton Fireman, Extension Soils Specialist
12:45 P.M.	Lunch (at College Dining Hall)
1:30 P.M.	Pasture Plant Ecology— L. J. Berry, Extension Range Improvement Specialist
2:30 P.M.	Land Grading and Preparation— L. J. Booher, Extension Irrigationist
3:30 P.M.	Water Application Systems— D. L. Henderson, Associate Professor of Irrigation Science

THURSDAY, NOVEMBER 13, 1958

9:00 A.M.	Surface and Sub-Surface Drainage— Clyde Houston, Extension Irrigation and Drainage Specialist
10:30 A.M.	Summation of Above, and Application to MAD Programs— George Whitten, Delta MAD Source Reduction Specialist
11:00 A.M.	Cooperation Between MAD's and County Extension Offices — Staff Member of Regional Office of Ag. Extension Service

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REPORT OF THE WAYS AND MEANS COMMITTEE

The Ways and Means Committee held one meeting on September 25, 1958, in Bakersfield, at which time it was decided to attempt to place all our emphasis during this year on a study of personnel classification in an effort to simplify and standardize position titles and duties.

The Board of Directors of the CMCA met on the following day accepting the report of this committee and directed the committee to utilize the facilities of the Bureau of Personnel and Training and the Bureau of Vector Control of the State Health Department in furthering this objective.

A sub-committee meeting was subsequently held on January 16, 1959, in Stockton with representatives of these Bureaus, at which time a plan of procedure was outlined to initiate a study of five representative agencies, with a final report to be made available by January 1, 1960 for distribution to member agencies.

The Board of Directors further directed the Ways and Means Committee to prepare an amendment to the CMCA By-Laws providing for a change in the trustee representation on the Board of Directors from one member, to one member from each region. This was drawn up and submitted to the Secretary by November 13, 1958.

Respectfully submitted,

Robert H. Peters, Chairman
Ways and Means Committee

Pres. Portman: Is someone here now that can make a report for the Insecticides and Herbicides Committee. No? We have one other Committee which has not made a report. I do not know if they wish to say something or not, but I would like to comment on this committee. It is the 28th Annual Conference Program Committee, 1959. Chairman, Gordon F. Smith, Eastside Mosquito Abatement District. Richard F. Peters, Bureau of Vector Control, C. Donald Grant, San Mateo County Mosquito Abatement District, and E. Chester Robinson, Alameda County Mosquito Abatement District. Does the Committee wish to say anything? I really don't think they ought to say anything. I think we ought to tell them what an excellent job they have done. Let's give them a hand.

Mr. Washburn: There are two reports that should be made to the Conference. One is the report of the Herms' Award Committee, which has been assumed by the Secretary's office, since it is a matter of just procedure.

HERMS' AWARD REPORT

During May of 1958 the amount of $50.00 was sent to the Mt. Diablo Council of Boy Scouts of America, Berkeley, California. This amount was used to partially defray the cost of sending two boys to the Scout summer camp at Camp Wolfeboro.

This award was gratefully acknowledged by Mr. Victor Linblad, Scout Executive of the Mt. Diablo Council.

G. Edwin Washburn, Chairman
Herms' Award Committee

The second is a financial statement which should be read to the Association, partly in explanation of some procedures which were carried out during the past year which may have been misunderstood by some of you.

FINANCIAL REPORT OF THE SECRETARY-TREASURER

Herewith is submitted the financial report of the Secretary-Treasurer of this Association for the period January 1, 1958, to December 31, 1958, inclusive. This report is submitted with certain reservations and explanations because of two events which happened by accident during the year due to bookkeeping procedures. The first happened in Fresno, when the Hacienda Hotel lost a batch of checks which they had lost at the time of the Conference, some of them ours. The second was caused by a three way bookkeeping error by the bank in which our accounts were mixed up with two others from March of last year until December 22 of last year, and finally got straightened out on January 23, just recently. These, we believe, have been corrected. Because of these events made last March, it appeared that we were without funds, in fact we had a notice from the bank that we were without funds. I checked with the bank at that time. The bank checked, and none of us discovered the errors that had been made. This caused me to send out notices to the Corporate Members of contractual payments in July. Since the fiscal affairs have been straightened out there will be no contractual payments due for those agencies that paid during 1958 until January 1960. The By-Laws state that the contractual payments were to be negated as far as the year 1958 was concerned and not picked up until 1959. Some of you, I know, couldn't understand why you got notices of these payments when they were not due. But they are due now, of course. There are only six districts of the total number of 44 members involved who have not paid their contractual payments, and those are still valid and will be billed.

The actual Financial Statement follows:

FINANCIAL STATEMENT

On Jan. 5, 1958, the bank balance stood at	$ 5,002.77
Total year's income	5,545.50
	$10,548.27

The breakdown will appear at a later date. The expenditures this year have been comparatively light compared to some of the years in the past. I do not think that will be the case in 1959, because some commitments have already taken care of some of the funds. We expended during the year of 1958: $3,687.64. Leaving a balance as of January 1, 1959, of $4,418.13, and we still have some funds on deposit which leaves a total balance of revenue available December 31, 1958 of $6,918.13.

Pres. Portman: The individual mosquito control agencies in this State and this Association, as well as the State Health Department, have been interested for a number of years in a program of operational and research aid, which is termed by the Legislature as subvention. Recently there appeared an article in the Sacramento Bee which brought this to the attention of a number of individuals throughout the State, and undoubtedly there has been a lot of discussion about it. I would like to read this article so that if some of you haven't seen it for yourself, you will know what it says.

"BROWN WOULD END STATE AID TO MOSQUITO DISTRICTS

"An end to State subsidies to most local mosquito abatement districts is recommended by Governor Edmund G. Brown in his budget message to the legislature. Governor Brown said elimination of State funds to districts, except those taxing at the maximum forty cents per hundred dollars of assessed valuation rate, would save the State $390,000.00 during the next fiscal year.

"George Umberger, Manager of the Sacramento-Yolo Mosquito Abatement District, said that the Sacramento Region would not be affected. In the last fiscal year, Umberger said, the local district only got $6,000 from the State, and that this amount was used to prepare reports for the State. He stated that he believes the Governor is using good judgment. In the past, Umberger noted, he has urged the legislature to provide funds for actual control of mosquitoes, but this purpose largely has been defeated because some districts use the money for purposes other than control. There are

forty-eight mosquito abatement districts in the State and twenty-five have been getting funds."

Yesterday, after our regular session, before the hospitality hour, I asked the Board of Directors to meet in order that they might discuss this matter and have something, possibly, to present today. They discussed the matter from many standpoints, and it was the consensus of opinion that, as a body representing many mosquito abatement districts, they felt that this operational and research aid to the districts should continue. The result was that a resolution was proposed and adopted by the Board; it is now presented to the Association for general adoption.

CALIFORNIA MOSQUITO CONTROL ASSOCIATION, INC.

RESOLUTION #1

NEED FOR CONTINUATION OF STATE SUBVENTION FOR MOSQUITO CONTROL

WHEREAS the California Mosquito Control Association with membership composed of 40 local governmental agencies throughout the State of California, holding its Twenty-seventh Annual Conference at Monterey, California, February 2, 3 and 4, 1959, has come into awareness of a proposed drastic reduction of the fund for State Subvention to local mosquito control agencies in the 1959-60 fiscal year budget of the State of California, and

WHEREAS it is evident that Governor Brown has not been accurately advised of the great significance of the purposes which this subvention is serving and for which its continuation is required, namely:

(1) The major research effort directed toward the development of improved mosquito control technology in California depends upon this fund.

(2) The encephalitis and malaria surveillance program of the State is founded upon the network of local mosquito control agencies participating in the subvention program, and

(3) Operational assistance is furnished to only those agencies characterized by economic hardship stemming from low assessed valuation and severe mosquito problem, and

WHEREAS the specific major problems of mosquito control are today caused largely by artificial conditions associated with the State water resources development program, irrigated agriculture, industrial expansion and population increase, and

WHEREAS in response to the growing statewide mosquito problem, the area served and the overall cost to local mosquito control agencies has increased approximately 700 per cent while the amount of State support of mosquito control has remained unchanged since 1946.

NOW THEREFORE BE IT RESOLVED that this Association through this Resolution respectfully urges that the necessary steps be taken through the State administration and the legislature to restore a minimum of $400,000.00 in Fiscal Year 1959-60 for allocation on the same basis as characterizes the current Fiscal Year.

BE IT FURTHER RESOLVED that the Secretary of this Association is instructed to transmit copies of this Resolution to Governor Edmund G. Brown, to Dr. Malcolm H. Merrill, State Department of Public Health, to each member of the State Legislature and to all local Health Departments and Mosquito Abatement Districts in California.

You have heard the problem with which we are faced and have heard the expression of your Board of Directors in regard to this matter. I would like to entertain, now, an expression of the wishes of the membership of this Association.

Mr. Raley: In the Board's discussion are there any modifications of this proposal that is being presented? The four hundred thousand dollars doesn't seem likely. Are there other courses of action that could be taken that might salvage perhaps a part?

Pres. Portman: I might answer in this respect: that such was definitely discussed, but the Board felt that we should ask for this operational aid and research assistance in the same amount as has been asked for in the past, because, as was stated in the Resolution, our operational costs have gone up some seven hundred per cent, while the amount of subsidy remains the same. Actually in the overall picture, the total budgetwise in Sacramento is a small and piddling amount.

Mr. Raley: I do not deny any of that. Yet, if discussions are held with individual legislators, and the economy wave which has been proposed impressed itself on their minds, they will not stand still for four hundred thousand dollars. Now, are there any other courses which this group might feel are advisable? If you can't get the whole, then what would be the best approach?

Pres. Portman: We will take as much as we can get.

Mr. Raley: You can't just say that. You must have a concrete positive proposal to back you up. You can't say give me anything that you are willing to. You have to have some proposal to present.

Dr. Murray: Mr. Chairman, I believe that the situation would be handled best if we avoid any confusion whatsoever. Let us maintain the whereases that you have given and if they wish to select any of those whereases, that is their perogative. We cannot deny them, but let us, ourselves, not offer any ground for confusion.

Mr. Kingsley: (Merced County) Are there any districts that have a forty cent tax rate?

Pres. Portman: Yes. There is one. Pine Grove.

Glen Gerken: (Compton Creek) Mr. President, I move that we go on record passing the motion as prepared.

Mr. Grant: I second the motion.

Pres. Portman: It has been so moved and seconded. Are you ready for the question?

I believe that in this regard we should have a roll call vote, and I will call the names of the Corporate Members.

Alameda County MAD	Yes
Antelope Valley MAD	Yes
Ballona Creek MAD	Yes
Butte County MAD	Yes

Carpenteria Pest Abate. Dist.	Absent
Coachella Valley MAD	Absent
Coalinga-Huron MAD	Absent
Compton Creek MAD	Yes
Consolidated MAD	Yes
Contra Costa MAD	Absent
Corcoran MAD	Yes
Corning MAD	Yes
Delano MAD	Absent
Delta MAD	Yes
Diablo Valley MAD	Absent
Durham MAD	Yes
East Side MAD	Yes
Eureka Mosquito & Rodent Cont. Dist.	Absent
Fresno MAD	Yes
Kern MAD	No
Kings MAD	Yes
Lake County MAD	Absent
Los Angeles City Health Dept.	Absent
Los Molinos MAD	Yes
Madera County MAD	Yes
Marin County MAD	Yes
Matadero MAD	Yes
Merced County MAD	Yes
Napa County MAD	Yes
Northern Salinas Valley MAD	Yes
Northern San Joaquin County MAD	Yes
Orange County MAD	Yes
Oroville MAD	Absent
Pine Grove MAD	Yes
Red Bluff MAD	Yes
Sacramento County-Yolo County MAD	No
San Diego County Health Dept.	Absent
San Joaquin MAD	Yes
San Mateo County MAD	Yes
Santa Clara County Health Dept.	Yes
Shasta MAD	Yes
Solano County MAD	Yes
Sonoma County MAD	Absent
Southeast MAD	Yes
Sutter-Yuba MAD	Absent
Tulare MAD	Yes
Turlock MAD	Yes
West Side MAD	Yes

Now, are there any other representatives of agencies who I have not called that are Corporate Members? Of those members present and voting, all voted yes with the exception of two; therefore the resolution has been passed.

I would like to ask now, is there any other business to be brought up at this time? If not, is there any new business to be brought before us at this time?

Mr. McFarland: I would like to move that the Dairy Wastes Committee be made a subcommittee of the Source Reduction Committee as a standing Committee.

Pres. Portman: Do you wish this voted upon? All right. This will be proposed to the new President and the Board of Directors and Officers. Is that right?

Dr. Murray: I will second the motion.

Pres. Portman: It has been moved and seconded that the Dairy Wastes Committee be made a Subcommittee of the Standing Committee on Source Reduction. Are you ready for the question? All those in favor signify by saying aye. Opposed? None. So ordered.

Is there any further new business to be brought before the floor at this time?

Bob Peters: I believe that in order to make our procedures legal, a motion should be entertained to accept all of the reports that were not acted upon after presentation; therefore, I move that all of the Committee reports which we received this morning be accepted by the Association.

Pres. Portman: Thank you, Bob. Do I hear a second to that motion?

Mr. Kelsey: I second the motion.

Pres. Portman: All those in favor of the motion signify by the usual sign. Aye. All those opposed? None. So ordered.

Any other further business?

Harold Gray: I have no right to propose, being retired, but I would like to ask the question of procedure at the annual meeting as to whether it is best to have a motion validating the actions of the Board of Directors during the past year.

Pres. Portman: Do I hear a motion to that effect?

Mr. Grant: I move that the currently assembled members approve the actions of the Board of Directors taken during the past Conference year.

Mr. Brumbaugh: I second the motion.

Pres. Portman: It has been moved and seconded. All those in favor signify by the usual sign. Aye. Opposed? None. So ordered.

Mr. Brawley: I believe that at one of our Board meetings we directed that the Vice President and the Secretary draw up a budget for presentation. Does this happen to come under new business?

Mr. Washburn: We are presenting herewith a tentative budget for the year 1959 based on facts as known today. We had no system to go by, or procedures other than those we had used in the past. You remember last year that the Budget Committee presented procedures and recommendations that were not accepted by the Annual Meeting. The tentative budget for the coming year, 1959, Gordon Smith and I have developed and is as follows:

TENTATIVE BUDGET
CALIFORNIA MOSQUITO CONTROL ASSOCIATION, INC.
1959

Revenue —	
Contractual Payments Due	$ 600.00
Associate Member Dues	75.00
Sustaining Member Dues	200.00
27th Conference Exhibit Space Rentals	550.00
Conference Registration Fees — est.	1,000.00
Conference Dinner Tickets — est.	750.00
Publications Sales	50.00
Other Income	100.00
Total Income	2,830.00

TENTATIVE DISBURSEMENTS 1959

Printing 27th Proceedings	$1,600.00
Recording Services	200.00
Stenographic Services	200.00
Conference Costs—Rentals, Dinner, Etc.	1,800.00
Postage	100.00
Stationery	100.00
One-half Page Ad in *Mosquito News* (2 Years)	216.00
William B. Herms Award	50.00
Condolences	25.00
Telephone — Long Distance	100.00
Mosquito Guide Printing	550.00
Mosquito Guide Drawings	55.50
Asilomar Conference Fee	25.00

Office Supplies		50.00
Office of Secretary		300.00
Office of Treasurer		100.00
1959 Yearbook Printing		200.00
Secretary and President to AMCA		250.00
Total Disbursements		$5,921.50
Recap:		
Income	$2,830.00	
Bank Balance – Jan. 1, 1959	4,418.13	
Total		$7,248.13
Disbursements		5,921.50
Balance		$1,326.63
Building and Loan Deposit (Reserve)		$2,500.00

G. Edwin Washburn
Gordon F. Smith

Mr. Cavanaugh: (Coachella Valley) I would like to introduce at this time Mr. Pat Cohen of Palm Springs, who would like to speak in regard to an invitation for holding next year's CMCA Annual Conference.

Pat Cohen: Gentlemen, as Art says, on behalf of the Coachella Valley Mosquito Abatement District and the desert, I will hurriedly read these letters to you.

(Mr. Cohen read letters from the Mayor, Chamber of Commerce and Convention Bureau of Palm Springs.)

And I wish personally and cordially, on behalf of Palm Springs and the desert, to invite your convention in 1961 to Palm Springs.

Pres. Portman: Thank you, Mr. Cohen. I will now recognize Gardner McFarland.

Mr. McFarland: I would like to mention that Los Angeles, also in 1960 or '61 would like to invite the Conference, and there will be a lobby from the Convention Bureau and Los Angeles Chamber of Commerce, and the Disneyland Enterprises cordially invites you to meet with them in this regard, and give the northerners a chance to enjoy their facilities.

Pres. Portman: I have also had a verbal request, long outstanding, from the Sutter-Yuba Mosquito Abatement District to hold the Conference up there. I don't believe Dick Sperbeck is here this morning. Is Marion Bew here?

Mr. Bew: I will be wearing two hats here, Bob. One as President of the Sutter-Yuba District and one as a member of the Chamber of Commerce Convention Bureau. There are also letters from the mayor, the Board of Supervisors, and all of the political bodies have asked me to express their personal invitation to you all to come up to Marysville and hold your Conference for the 1960 meetings. Thank you.

Pres. Portman: There appears to be another verbal request from the Sacramento-Yolo Mosquito Abatement District by Cal Rourke.

Mr. Rourke: I have here today a formal invitation for this Mosquito Control Association to hold its next Conference in the Capitol City of Sacramento. One of our Board members, Mr. Bert Geisreiter, who happens to be the Convention Manager, said that he would do his utmost to make this Convention a very successful one should the Association plan on having its Conference in Sacramento.

Pres. Portman: I have also received two telegrams directed to me. (Telegrams from the Mayor and Chamber of Commerce of Stockton were read.)

In addition to that I have a verbal request from Les Brumbaugh to the same effect.

Mr. Brumbaugh: Thank you, Bob. The Stockton Chamber of Commerce and the Mosquito Abatement District would like to invite you to Stockton in either 1961 or '62 to enjoy the facilities of our great establishment in the valley. We do have a new hotel called the Ambassador that could serve us very nicely as well as the American Mosquito Control Association. We do have boats, we have rivers, we have fishing and hunting, whether duck season and the pheasant season will be running at the time of the Conference is a question, but I know that arrangements could be made. We have plenty of boats for you, and we can take them into the channel very easily; we do have the entertainment and the facilities that will help you to enjoy your stay in Stockton. We feel very badly that in 1955, when we had those hurried arrangements and we only had about two weeks due to the floods in Marysville, that you met in Stockton; and now we would like to have the opportunity to give you a ball. Thank you.

Mr. Raley: They wanted me to present the invitation from Fresno, but Ed won't do it.

Pres. Portman: Does anyone else wish to be heard from the floor in this same vein of thought? We have certainly had a number of excellent invitations, and in that there is considerable consideration entailed in this, I believe it should be the task of the incoming officers to make the decision.

I would like, at this time, to call on Jack Kimball, Chairman of the Nominating Committee. Jack Kimball.

Mr. Kimball: Ladies and gentlemen: the Nominating Committee, in case you are not familiar with its appointment, was appointed by the Board of Directors on September 26 at its meeting in Bakersfield, and the Nominating Committee was chosen by the Board, composed of one member from each of the five regions, as indicated in the report.

NOMINATING COMMITTEE REPORT
January 6, 1959

All Corporate Members
California Mosquito Control Association

The Nominating Committee composed of one member from each of the five Regional Areas, was appointed by the Board of Directors on September 26, 1958. Before nominees for 1959 were selected, this Committee unanimously agreed that the needs of the Association would be better served if the offices of Secretary and Treasurer were not held by the same individual. Mr. G. Edwin Washburn, who has carried the entire load of both Secretary and Treasurer for the past seven years, agreed with this decision.

The Nominating Committee has selected the following nominees for the offices of the Association for the year 1959:

President	Gordon F. Smith	East Side MAD
Vice-President	Gardner C. McFarland	Southeast MAD
Trustee Member	A. S. Glikbarg	No. Salinas Valley MAD
Secretary	G. Edwin Washburn	Turlock MAD
Treasurer	John O. Stivers	Merced County MAD

In accordance with Article IV, Section 7 of the Association By-Laws, additional nominations may be made from the floor at the Annual Meeting, but only if the proposed nominee has given prior consent to serve if elected.

Respectfully submitted,

Joseph D. Willis

Howard R. Greenfield

Robert H. Peters

W. Donald Murray

Jack H. Kimball, Chairman

Pres. Portman: Thank you, Jack. Are there any nominations for the various offices from the floor?

Dr. Murray: I take pleasure in nominating for the position of Treasurer, Mr. Lester Brumbaugh.

Mr. Kimball: I second the nomination.

Pres. Portman: The nomination has been made and seconded for Mr. Brumbaugh to the Office of Treasurer.

Harold Gray: I believe there is a point in doubt. Does this comply with our regulations regarding nominations in our Constitution and Bylaws?

Mr. Grant: Under our new Constitution adopted last year, yes.

Pres. Portman: Are there any other nominations from the floor? I hear none. Neither the Secretary nor myself have received any nominations prior to this time. Therefore, I wish to hear your pleasure in this matter.

Mr. Ecke: I move that the nominations be closed.

Mr. Enos: (Alameda Co.) I second the motion.

Pres. Portman: It has been moved and seconded that the nominations be closed. Are you ready for the question? All those in favor so signify with the usual sign. (Aye.) Those opposed? None. So ordered.

There is one other point of business which is necessary each year, and I feel that it is extremely important to all of the agencies involved in this Association. That is the selection of your area representatives.

Mr. Grant: I rise on a point of order. Should not action be taken on the actual election of officers, either through requesting the Secretary to cast a white ballot or—

Mr. Washburn: I believe under Roberts' Rules of Order that when there is only one nominee for each office that it is an automatic election.

Mr. Grant: If you so wish.

Pres. Portman: Do you gentlemen want to get together, without leaving and breaking up, for about five minutes in this room—and I say again, this is not a recess—to make your selections and report as to your regional representatives for the coming year?

Dr. Murray: Bob, I believe that has already been done, at least by some.

Mr. Kimball: As Regional Representative for the Southern California area, I would like to report that at our regional meeting we elected Mr._____. Let's see . . . What was his name? Oh! Norm Hauret from the Ballona Creek Mosquito Abatement District.

Pres. Portman: I would be glad to hear reports from any other region at this time.

Mr. Brawley: Mr. President, I am sorry to say that I was the San Joaquin Valley's voice last year, and they did it again. I am your new member.

Mr. Brumbaugh: I represent the Northern San Joaquin Region and I am happy to say Mr. Bob Peters is our new representative.

Pres. Portman: With your indulgence we will wait a minute to see if either the Coastal Area or the Sacramento Valley Region comes up with a representative.

Mr. Bollerud: Mr. Chairman, I am not sure there are enough of us present to hold a caucus and elect a representative at this time.

Pres. Portman: All right. You can report it at a later time. Chet, does the Bay Region wish more time?

Mr. Robinson: Yes. We can meet at recess and let you know right afterwards.

Pres. Portman: Now I would like to have Gordon Smith, of the East Side Mosquito Abatement District, your new President, come up here and take over.

Pres. Smith: Thank you, Bob. I sincerely appreciate being elected President of the Association, and I feel that I can speak for the other Officers as well as myself in saying that we shall do our level best in carrying on the busines of the Association in a manner which will please all concerned. We will now have a recess for ten minutes.

RECESS

Pres. Smith: Before we start the next session of the program, I would like to call on the two lazy areas to see if they have their new representatives to the Board of Trustees elected, appointed, railroaded or otherwise. Chet.

Mr. Robinson: Howard Greenfield, having had the chickenpox and not being able to come, was elected representative for the coming year for the Coastal Region.

Pres. Smith: Bill Bollerud. Who is from the Sacramento Valley?

Mr. _____: Bill is having a cup of coffee, but Dick Sperbeck was elected representative for the Sacramento Valley.

Mr. Gray: Is there someone here from the Northern Salinas Valley Mosquito Abatement District? We have this letter to Howard with all the signatures now. Bob Wood? I wonder if you would take this over to Howard.

While I am on my feet, the Entomology Committee has presented the old man with this new "Field Guide to the Common Mosquitoes of California," and I want to express my deepest appreciation for it.

Pres. Smith: There are two announcements before we go on with the program. First, I would like to call a brief meeting of the Board of Directors to convene immediately after the close of the program. There are a few small items that should be taken care of.

Second, several people have spoken to me and asked me to remind you that the resolution passed this morning, concerning subvention, is not the end of it; that you should all get together and contact your own State Assemblyman and Senators, and see to it that they know what the individual feelings of your districts are. Please do.

The final item on the program this morning is "Equipment and Insecticide Use and Development Within California Mosquito Control Agencies." I will call on Ted Raley, Manager of the Consolidated Mosquito Abatement District.

Mr. Raley: Thank you, Gordon. The title is quite imposing, but due to a limitation in time and to the facili-

ties available here, the great part of my presentation this morning will be an invitation to all of you, which will be supplemented later with a formal invitation, to an equipment meeting in Fresno in the early Spring. This year it will be in either late March or early April. We feel that this perhaps will give a better opportunity for foremen, operators, and the people intimately associated with the equipment to handle it, and to talk with other people who have to work with it each day. So fix your schedule now with this thought in mind that in late March or early April there will be an equipment meeting in Fresno, and we hope that you will all be there.

Before I pass on to the equipment demonstration part of this presentation, I would like to take this opportunity of getting one item from my brief case. I would like to encourage all of you who are already AMCA members to be sure that every one in your organization who is concerned with the supervisorial and/or technical part of your operation has access to *Mosquito News*. Because of the very considerable practical and helpful information published in this journal it will lead to a better understanding of mosquito control as a total program if they have access to *Mosquito News* regularly. Don Grant has the lapel pins for the Association members, so if any of you have as yet failed to get one of those I am sure that he will be happy to take your dollar and a half and personally attach the lapel pin to your coat and kiss you on both cheeks. Now I only ask that while he does that, you do not pat his head.

In deference to time and in courtesy to those people that we work with throughout the years in our purchasing, the men who have provided many of the facilities that we work with, I will turn the meeting over now to Chester Robinson and ask him to introduce the commercial people here with us, and let them describe the product that they are particularly interested in.

Mr. Robinson: Well, as usual, we have changes here. The equipment men, with their heavy equipment, are all ready to demonstrate—out in back. We will go right across the road—straight in back of us—

Is Ted Hubbard in the room—from American Dynamics? He is the man who has the battery additive, in there. He will demonstrate it.

Is Mr. Bruce, from the Ford Motor Company here? Mr. Bruce, would you like to come and just tell us about that new four-wheel drive pickup?

Mr. Bruce: Good morning, gentlemen. I know that you have all been acquainted with a four-wheel drive vehicle before, but possibly not with the Ford Motor Company's unit. We have just introduced this, and they are available in two classes: the F-100 and the F-250, which are the half-ton and three-quarter-ton models. The combinations which we have are either in the three-speed or the four-speed transmissions. Actually, the model that we have here is the F-100, which we will have on display up on the hill. You gentlemen may have a chance to put your hands on it. Specifically (getting down to some points that maybe you gentlemen are interested in—in the type of unit and particulars as far as development is concerned) we, in conjunction with Spicer, put this unit together. In other words, we are using their transfer case, and we are using their front axle assembly. From there on, it's a joint venture, with Ford and Spicer, together. I'll just leave it at that, and will be available for questions and will try to point out all of the interesting features to you on the vehicle.

Mr. Robinson: Is anyone here from John Bean Division of Food Machinery Corporation? I know they are going to have their equipment here, so they are probably all up on the hill. Livestock Sprayers? I believe they are all up there. Willys Motors will be represented up there by other units. I don't see Kent Robinson, of Willys Motors. Is he around? Is the International Harvester representative here? They have a four-passenger pickup out here that is rather an interesting innovation in pickups. I think most of you saw it out in front.

Moyer Chemical? Nobody here from Moyer? Where did Ken Gillies go?

Pacific Associates? I believe they are all set up on the hill.

Fresno Agricultural Chemicals? Anybody here from them?

Pacific Pump? They have their display in here. I don't think they will have anything up on the hill. They have pump sprayers and other equipment that we normally use.

Harang Engineering? I don't think they will be up on the hill, either, but they handle various spray parts, including Spraying Systems' Tee-Jet. Delmer Engineers sent up a couple of hundred of these Sputnicks. They are right in the corner in the display room. One box has this little jigger—so you take out one of those, and put it on the bottle, and it is supposed to kill all the flies and mosquitoes in your bedroom, bathroom, and kitchen. Help yourself. They are free.

Mr. Shine, of Bessler Corporation, I know, is ready to demonstrate, with the rest of the exhibitors.

Did we miss anybody here on the equipment or insecticide deal? If not, we will adjourn the meeting here and meet back on the golf course and have a demonstration of a variety of spraying equipment.

FOURTH SESSION

TUESDAY, FEBRUARY 3, 1959, 1:30 P.M.

Pres. Smith: The first portion of the program this afternoon is a symposium on related activities of local mosquito control agencies. I will turn the meeting over to Don Grant of the San Mateo County Mosquito Abatement District, since he is the one who got this symposium together, I will ask him to run it.

SYMPOSIUM ON RELATED ACTIVITIES OF MOSQUITO CONTROL AGENCIES

Moderator: C. Donald Grant

Speakers: Dr. A. D. Hess
Richard F. Peters
Robert E. Dolphin
Dr. Mir S. Mulla
Thomas H. Lauret
Merrill A. Wood
Jack H. Kimball

Mr. Grant: Thank you, President Smith. We have some of our speakers sitting down here in front at the present time, and it may be just as well for them to retain their seats there, since they will be speaking individually.

INTRODUCTION

C. Donald Grant, *Moderator*

San Mateo County Mosquito Abatement District

I have a strong personal interest in the words of our speakers on this symposium, since my own District has in the past few years received many requests from individuals and various public organizations for a greater coverage in providing control measures upon many other types of insects that to varying degrees actually do constitute a public nuisance.

Four years ago our District apparently reached its peak of efficiency in regard to coping with our various mosquito sources. Our natural sources—the salt marsh and the fresh floodwater areas—have become negligible in need for abatement effort; but each successive year of late has been demanding a greater workload, more actual treatment, without further lowering of the mosquito prevalence. On top of this we have met increasing public demand for control of gnats, midges, flies and other noxious insects which are beyond the sphere of the private pest control agencies and for which no other public agency accepts control responsibilities. The analysis as to why we have met these increased demands and work loads is readily summed up in gross terms: California's rapid population growth is continually exceeding its development of adequate disposal systems for removal of the organic wastes, especially the water carrier systems.

Along with California's rapid growth have come new problems, significant problems, for which we have neither adequately developed control methods or even established realms of responsibility. During the past few years these new problems have been most obvious in the areas of greatest population growth—urbanization invading nature's frontiers or the farmer's fields. Not only have they been met by arthropod populations endemic to these areas, but often of even more consequence, they have created new problem sources which provide tremendous numbers of insects thriving on the improperly cared for organic wastes resulting from such human population expansion.

At least a dozen mosquito abatement districts and several health departments in California have been recently confronted with serious problems in this regard. Some are actually engaged in control efforts upon a variety of insects causing a public nuisance, many others are on the threshold, waiting for someone else to accept the responsibility or be pushed into such control work by public demand. Some preparatory work and study is being done in anticipation of coming needs, but the effort is small in view of the extent and complexities of the problems.

This symposium was initiated through the request of several districts faced with the question of expanded vector control work and some of its subsidiary aspects. Indeed, the many diverse subjects with which mosquito abatement operations must now be familiar in varying degrees makes it difficult to provide coverage for all of them in any one conference, let alone symposium. However, emphasis is here given to consideration of expanded vector control pertaining to other insect nuisances, some probabilities in control approaches, and the research programs currently being directed at some of these insects in California.

We are most fortunate in having Dr. Archie Hess and Richard F. Peters with us to speak upon these subjects, since they have not only had to face such varied phases of vector control over the past years, but have been leaders in developing the thought and organization pertinent to such practices in anticipation of the situations with which we are now confronted.

Our first subject on this symposium is "The Expanding Vector Control Interests of Mosquito Abatement Organizations" to be given by Dr. Archie D. Hess, Chief of the Greeley Field Station in Colorado, formerly at Logan, Utah. Archie is also President-Elect of the American Mosquito Control Association and Program Chairman for their coming meetings in Salt Lake City.

THE EXPANDING VECTOR CONTROL INTERESTS OF MOSQUITO ABATEMENT ORGANIZATIONS*

A. D. HESS*

Abstract

A survey was made of mosquito abatement organizations to determine vector control activities and interests other than mosquito control. The organizations surveyed were located in California, Florida, Illinois, Massachusetts, Minnesota, New Jersey, North Dakota, Oregon, South Carolina, Texas, Utah, and Washington.

It was found that about half of the organizations are currently engaged in other vector control activities in addition to mosquito control. The most common of these was fly control. The following types of control activities were also represented: biting gnats (*Culicoides, Leptoconops*, etc.); non-biting gnats and midges (Chironomids, *Chaoborus*, etc.); ticks, mites, and chiggers; fleas; rodents; insect pests of ornamental plants; aquatic plants and terrestrial weeds; and general sanitation and vector control, including garbage, refuse, and sewage disposal. The major problems encountered in connection with these control operations were inadequate personnel and equipment and lack of public cooperation.

Over three-fourths of the organizations felt that they should be engaged in other vector control activities in addition to mosquito control. Fly control was the additional activity in which most were interested, but a considerable portion indicated they should be concerned with the control of all insects of public health importance. Other types named were control of biting and non-biting gnats (including eye gnats, *Hippelates* spp.), fleas, roaches, ticks, horseflies and deerflies (Tabanidae), and "highway drainage."

The organizations were asked what types of research would be most beneficial to their operations within the next few weeks. Most of them named research related to the development and utilization of improved insecticides, including studies on resistance and toxic hazards. A considerable portion also indicated a need for physiological and biological research; the flight dispersion habits of mosquitoes was an item of special interest. There was also a marked interest in research on source reduction techniques, particularly with regard to improved soil and water management practices.

Mr. Grant: Thank you, very much, Archie. It looks like you predict that we will be getting pretty far afield in other activities. Just how far it will take us, I don't know. Certainly, the problem is not one which is going to be solved in one year, two years, or five years. It is a tremendously greater problem in many ways than the simple task of killing mosquitoes, with which we seem to have some problems.

As to the approaches to meeting these problems, and probably we are going to run into a great many problems over a period of time, certainly the Bureau of Vector Control has been looking ahead over the past several years to anticipate some of these needs, to evolve policies and certain patterns of approach within what experience they have. We have had a little research work upon it, not very much, and in the future it looks like we are going to need a great deal more. Of course, we run into problems in financing this work, on which something might be said later.

I think Dick Peters, Chief of the Bureau of Vector Control, has been exceedingly close to this problem of expanded vector control. He is probably one of the most informed and progressive individuals in the field, certainly within the United States, and we are very, very fortunate to have such a man as head of the Bureau of Vector Control in this State, to aid us in meeting these problems. I just hope that Dick might be able to tell us what we might expect on this subject. Dick Peters, Chief of the Bureau of Vector Control, State Department of Public Health.

Mr. Peters: Thank you, Don, for your over-zealous introduction. Now that you have heard Archie's side of the record, we will turn the record over and I'll play my side. It will be similar orchestration, with only the vocalist different. You notice that I came possessed of a prepared paper today. I don't know when in the recent past you have listened to me give a paper from a prepared text. Here's why—

PLANNING BY LOCAL MOSQUITO CONTROL AGENCIES TO MEET BROADER NEEDS IN VECTOR CONTROL[1]

RICHARD PETERS[2]

The subject assigned to me by Don Grant may not be the most controversial in California mosquito control, but it's at least a runner-up to any other you wish to place first. Stated simply and directly, it asks the question: Should local public health agencies, including mosquito abatement districts, undertake organized control programs of noxious animals other than mosquitoes, and if so, why, what, where, when, how, and who? Already there are in clear evidence several schools of expression on this subject. I avoided saying schools of thought, because that would appear an unwarranted assumption at this point. Having said this, it now seems appropriate to establish my role and identity with respect to the subject. I shall engage in the expression of my views, based upon a limited analysis and understanding of the field of vector control. Under no circumstances do I pretend to champion any school of expression, let alone thought on this subject.

Clearly, this subject requires awareness of the roles, functions, and relationships of at least the following entities in this general field: Health Departments, Mosquito Abatement Districts, Pest Abatement Districts, Agricultural Commissioners, Farm Advisors, and Pest Control Operators, both domestic and agricultural. It is affirmed at the outset that no conflict with or needless duplication of program competently conducted by

* From the Communicable Disease Center, Bureau of State Services, Public Health Service, U.S. Department of Health, Education, and Welfare, Greeley, Colorado.

[1] Presented before the Twenty-seventh Annual Conference of the California Mosquito Association, Monterey, California.

[2] Chief, Bureau of Vector Control, California State Department of Public Health, Berkeley, California.

any of the aforementioned is under consideration within this subject. Rather, what isn't being done in vector control provides substance for this presentation.

At this point, a generalization or two is indicated. The vectors for which control planning is needed are defined and restricted to only those noxious animals adversely affecting the health and well-being of the public. This definition of convenience also allows for differentiating between vectors focalized to the individual premises, thus constituting a private problem and those vectors occurring in appreciable numbers within a community area, but originating beyond the individual premises, constituting a public problem. These qualifications now serve to characterize the vectors of concern as belonging within the broad group known legally as pests causing public nuisances, although some may be additionally involved in the transmission of diseases. Thus, with our scope clearly in the realm of human health and well-being, for practical purposes, we may now accept that the discussion will pertain to the role of either or both mosquito abatement districts and health departments. With respect to their legal latitudes, a mosquito abatement district may legally exterminate and abate mosquitoes, flies, and other insects (as well as rats under special circumstances) while a health department is unrestricted as to what it may undertake in preserving the public health.

Since I have already resorted to the newspaperman's standard approach in getting out his story, it would be consistent for me to follow through using his several one word questions and attempting answers to them.

WHY

Many local health agencies have not as yet answered to their own satisfaction why they should extend their present scope of activities to accept new or expand existing difficult and demanding programs.

Perhaps this can be explained by a consuming or even monopolizing dedication to existing programs, a lack of permitted latitude owing to fiscal restrictions, to the name "mosquito" abatement district connoting a singleness of purpose, to caution in embarking upon a new program having uncertainties, to a lack of technical staff prepared for new undertakings to an attitude of indifference or even complacency, or perhaps a combination of these and other things. Whatever the explanation, it appears desirable, necessary and even inescapable that local public health agencies recognize and accept their responsibility in vector control. This outlook is considered essential, particularly in California where people are the primary cause of vector problems. And people, with our future population expected to peak beyond 40 million, provide promise of compounding and complicating these problems and their solutions.

WHAT

Thus far, I have spoken of problems without reference to the specific vectors themselves for a good reason. In approaching the "what" of vector problems, I regard the environmental conditions or sources of the vectors to be the primary target of the needed programs.

Specifically, it appears that three major sources of noxious insects are conspicuously eligible for consideration. They are: (1) solid organic wastes supporting domestic flies, (2) lakes, ponds, and waterways supporting aquatic gnats, (3) special soil conditions supporting terrestrial gnats. All three appear to be on the increase in California or at least the expanding population seems destined to experience considerable adverse effects from these insects.

The "what" section would not be complete unless the mosquito problem in recreational areas were mentioned as a huge unmet need in California. To this should also be added the sizeable tick problem in our wilderness and mountain recreational areas.

Wasps and cone nose or kissing bugs are two other insects deserving of control attention when they occur in significant amount. All of these and others which time forbids touching upon qualify as arthropods of public health concern, since each is capable of drastically altering the public's normal way of life.

WHEN

Taking refuge in the oft used adage, "An ounce of prevention is worth a pound of cure", if the hypothesis is correct that people create most of the vector problems, it logically follows that the time to prepare to do something about the problems is now or at least soon. This implies the need for both immediate and long-range planning.

Every year lost in pondering whether or not something should be done, permits the vector problems to become more complicated and correspondingly more difficult and costly to overcome. If the problems increase in direct ratio to the growing population, it likewise follows that two-thirds of the overall problems expected to develop, remain largely preventable.

WHERE

Mention has been made of the proximity of the problems to human populations throughout the State. The domestic fly problem appears destined to become progressively greater with each passing year, eventually becoming virtually State-wide, including even the recreational areas. Wherever solid organic wastes are permitted to accumulate in small or large amount, in domestic, suburban, industrial, commercial, or agricultural locations, flies are an inevitable consequence. The ability of various fly species to travel several to many miles and their tremendous biotic potential assure that they will seek out and use every available habitat.

Experience both in California and elsewhere points out that aquatic gnats are increasing in all bodies of water receiving increased amounts of liquid organic wastes. Thus all forms of artificially created ponds or ponds for liquid wastes and lakes and streams receiving treated or untreated sewage, fertilizer and certain industrial wastes are becoming more suited to gnat propagation. At the same time, ponds for irrigation, recreation, or liquid waste disposal continue to be constructed or created in response to the growth of communities, industry, agriculture and recreation facilities.

Evidence from the heavily infested Coachella Valley suggests that *Hippelates* gnats are utilizing certain kinds of cultivated soil to extend their habitat range. These gnats are becoming increasingly evident in the San Joaquin Valley and have become acute problems in several other small valleys in Southern California.

Leptoconops gnats are known to occur in at least a dozen counties most of which are experiencing great

population growth. Each year finds more people severely tormented by these gnats.

Wasps in many parts of the State, particularly suburban areas and recreational areas, frequently make living out of doors exceedingly unpleasant and even dangerous. Cone-nose bugs are proving a serious problem in Mariposa and Fresno Counties along the western slope of the Sierra-Nevada mountains, in a variety of places in the Central Valley, and in desert areas of Southern California undergoing real estate development.

HOW

With the undertaking of "how", the plot really begins to thicken and my neck becomes further extended and more vulnerable to cleavers. In undertaking or even considering any vector control activity, there is only one logical first step. A comprehensive survey and appraisal of the problem is fundamental in order to understand the nature, scope, and likely cost of the venture. Properly done, such a comprehensive survey also provides the base line for any control undertaking, an essential to evaluating future control progress. Such a survey would require a minimum of a year and might even extend several years before reliable conclusions could be reached regarding the major implications of the control program required. The survey presupposes establishment of the best available objective measurement methods for the specific vector concerned. Continuation of such measurement practice is vital and would be expected to attend any control undertaking. Such a survey further presupposes use of competent entomological talent as well as collaboration of a variety of other technical fields.

The nature of the control undertakings would be expected to result from the survey findings and recommendations. It might safely be predicted that irrespective of the vector problem, the well-understood concept of source reduction and prevention of new sources would underlie any program. The employment of the educational - cooperational - persuasional approach would also be expected. This is particularly important with respect to inter-agency cooperation. The three major problems outlined previously, domestic flies, aquatic gnats and terrestrial gnats, closely oblige a public health agency to work in conjunction with a variety of related agencies and interests. It is obviously impossible for me to predict the likely cost of undertaking, and most important of all, effectively achieving control of domestic flies, or aquatic gnats, or terrestrial gnats, or wasps, or cone-nose bugs. I am willing to venture the opinion, however, that the cost of any or all will be within reason, and probably will require an increased amount less than that which we have come to accept to be required for mosquito control.

Discussing briefly the fly problem, which occupies the greatest amount of general interest, there are a number of promising ways to minimize governmental cost in fly control, by persuading or otherwise causing the interests responsible for accumulations of organic wastes to face up to this responsibility, and with technical assistance, to work out their own solutions. It even appears hopeful that solutions to many problems in this field, rather than being costly, could potentially be the opposite. Much remains to be done in the field of utilization of organic wastes. The program in fly control is visualized as a combination of diversified educational measures, inspection, specific problem solving and only limited chemical operations.

It is conspicuously evident that here, too, as is the case with mosquito control, research is an absolute must if effective solutions are to be obtained of fly problems. The research visualized should also be a cooperative undertaking utilizing the several State and federal agencies qualified to provide the specific kinds of effort required.

The aspect of statutes, ordinances and regulations in relationship to fly control is worthy of particular mention. Some individuals regard these legal aids with ridiculous reverence while others scorn their very existence. My attitude is neither, unless they are ill conceived, in which case I join the latter group. To me a public health statute, ordinance, or regulation worth using, should enunciate a needed level or condition based upon the best available knowledge to support the standard it would impose. Under no circumstances should an ordinance be arbitrarily developed and used as a club by which to compel submission. If the need exists for an ordinance and if the ordinance is founded on something meaningful and factual, it actually represents an educational opportunity. By using it as an educational tool, people can be made to understand why they are expected to observe the standard imposed. More often than not, with such understanding, they will themselves comply and demand such conformance by their neighbors as well. This is the most effective police power obtainable and it remains largely to be cultivated. If all ordinance makers and enforcers had this philosophy, the scorners would soon disappear.

Lastly, the fly control program must be undertaken area wide, including community, industrial, agricultural and natural conditions, if success is to be expected. To aim short of this I believe would be misrepresentation of trust and misuse of public funds.

WHO

It now remains to supply an interpretation of "who", that is, which governmental agencies have a responsibility for doing vector control and accordingly who should be doing more than at present. As you may have surmised, I do not intend to express an opinion that one or the other, health department or mosquito abatement district, should be singly identified with vector control responsibility. Rather, I wish to encourage complementary acceptance of responsibility by each. A health department is clearly unable to avoid responsibility for vector control. This does not necessarily mean that it must engage in the performance of vector control operations. Surely every local health department has the responsibility for planning and arranging to assure that adequate program is provided to achieve vector prevention and control. A health department should certainly be "architecting," that is, planning for the fulfillment of vector control program needs within its jurisdiction. It is obvious, however, that many health departments are already seriously underprovided with personnel and resources with which to engage in a program with the added administrative and technical demands characterizing vector control. Where such a situation exists and where a mosquito abatement district is administratively equipped to perform vector control functions, such might logically and properly be assumed by the district. This, of course, presupposes carefully

planned and integrated program with the local health department. Again it is emphasized that a mosquito abatement district is a public health agency. For a district to accept broadened responsibility in vector control in awareness of and with encouragement of the local health department is true evidence of inter-agency cooperation.

Mr. Grant: Thank you very much, Dick. The next few years will let you know whether you still have your neck or not. I certainly appreciate this—the operational phases of a mosquito abatement district versus the more administrative functions of a public health department, the need for both of them in cooperation as they come up and the individual solutions very dependent upon what the local problems are.

In reviewing some of the problems here within the State, and we have had some research programs going on for several years by local agencies, in the past year we have had some of these programs subvented in the amount of $50,000 total by State legislation putting up funds on a matching basis and administered through the State Public Health Department, under three local programs where they are setting up such studies approved by the State Health Department. Some of these have been going on for at least ten years; *Leptoconops* studies by San Mateo County for about three years. They are making progress, yet it is a long slow pull toward actually getting enough knowledge on the basic ecology of these to actually find the most feasible means of working out permanent or practical control methods for a long period of time. We have had very bad news in that apparently this $50,000 has been stricken from the Governor's budget for the following year. Whether anything can be done in restoration of that amount, I don't know. Certainly, research along this line is very much needed. I hope very much to see more of it undertaken.

The Bay area districts recently introduced a resolution to the CMCA Board of Directors, which is now undergoing modification, hoping that the CMCA will accept recognition of the role of the abatement of such outside insects and so on as are pertinent to mosquito abatement agencies. I feel that we will be making progress on this very shortly. Now I would like to call on reviews or summaries of these research programs, three of them. One on an aquatic gnat, *Chaoborus astictopus*, and two on terrestrial gnats: *Hippelates* eye gnats, found more in the southern portions of the State, and *Leptoconops torrens*, found from the central portion up through the northern area in the lower foothills and valleys. Of these programs under the assistance money from the State, certainly the largest program has been that on *Hippelates*, the eye gnat, and a great deal of it has been conducted in conjunction with the University of California at Riverside. Another program that has been going on for a number of years and that several people have done work on, principally in chemical control under specific conditions in Clear Lake, has been the problem of *Chaoborus astictopus*, the Clear Lake gnat. Recently the Lake County Mosquito Abatement District has appointed a new Manager-Entomologist, Robert E. Dolphin, who is with us today to tell us something about this program. Robert.

Mr. Dolphin: Thank you, Mr. Grant. I would like to take this opportunity to tell you about the Clear Lake Gnat, *Chaoborus astictopus*.

1959 LAKE COUNTY MOSQUITO ABATEMENT DISTRICT GNAT RESEARCH PROGRAM

Clear Lake Gnat (*Chaoborus astictopus*)

Robert Dolphin
Manager-Entomologist

Control of the Clear Lake gnat, *Chaoborus astictopus*, has been one of the more important functions of the Lake County Mosquito Abatement District since its formation in 1948. It is no exaggeration to state, that one of the main reasons for forming the District was for the purpose of gnat abatement. The Clear Lake gnat is a small, non-biting Culicid gnat that occurs at an extremely high population level in Clear Lake. (As of January 13, 1959, we had an average of 640 larvae per square foot of lake bottom). These gnats emerge in enormous flights during the Summer months and fly primarily at night. As they are attracted to lights, the gnats congregate in large numbers around and in, lakeshore homes, resorts and places of business. The annoyance created by these insects to tourists and residents, alike, greatly reduces the attractiveness of Clear Lake as a recreational area and poses a threat to resort income and to the general economic development of Lake County.

An effective control method was developed by Dr. Arthur W. Lindquist and his co-workers, and was first employed in the Fall of 1949. This same method, with slight modifications, was also utilized in 1954 and 1957. This method of control involves introducing approximately 40,000 gallons of a 30% DDD formulation into Clear Lake from drum-laden barges. The barges are driven along pre-determined parallel swaths and the formulation is pumped into the wake of the barge. Natural current, wind action, and diffusion distribute the insecticide throughout the lake to produce a uniform .02 ppm concentration. This concentration effected a 100% reduction of the larval population in the first two treatments, according to mud sampling data. A 96% reduction was realized in the 1957 treatment.

In December of 1957, several months after the Fall treatment, a local game warden discovered a number of dead Western Grebes on the lake. The tissues of these birds were found to contain high concentrations of DDD. This discovery led to tissue analyses of the game fish in Clear Lake and the insecticide was found to be present here also. Although the amount of DDD discovered in the tissues of the fish does not at present constitute a public health hazard, the further employment of DDD in the near future, would probably endanger the fish population, or the people feeding on these fish.

The necessity of increased research efforts developed as a result of this unforseen development. With the aid of state subvention funds for gnat research, the position of Research Entomologist was created and research activities were accelerated in July of 1958.

The major portion of our program to date, has been devoted to screening various insecticides, many of which have been used successfully in tests on mosquito larvae by the Bureau of Vector Control. Of the ones tested to date, Parathion and Trithion show the most

promise. The tests are preliminary in nature and perform the function of eliminating insecticides that do not hold promise as a gnat larvicide.

The materials that do hold promise as a potential treatment larvicide, will be subjected to further testing. The effects of pH, temperature, hardness, and other factors on insecticidal action and breakdown rate will be investigated. The breakdown rate is important because in the past it has taken three to four weeks to obtain complete control. We have already eliminated several phosphate insecticides because they hydrolyze rapidly and soon lose their toxic effects in the slightly alkaline water of Clear Lake. Suspended algae and mud particles will also have an effect, undoubtedly inhibitory in nature, and we shall have to determine this as well. In problems dealing with formulations we hope to get aid from the insecticide manufacturers to supplement our efforts. If we are fortunate enough to develop more than one treatment larvicide, the final selection will be governed by cost and safety considerations. The insecticide selected at this time will be used in a series of field tests involving farm ponds and small lakes prior to the actual treatment of Clear Lake. Due to the long testing procedure necessary to develop a treatment insecticide, it is doubtful if we will have one for this year's use. However, we will probably have one by 1960, if all goes well.

In order to provide our resort industry and visiting tourists with some degree of relief, we are investigating several stop-gap measures to combat this Summer's gnat flights. Gnat eggs laid on the lake surface have a tendency to accumulate in long drifts, due to winds and currents. It was discovered last Fall that these eggs are susceptible to Richfield Larvicide. We have made tentative plans to spray these egg drifts daily by plane during the gnat flights. Studies of the effectiveness of this approach and improvement of technique will be carried out at the same time. Ovicidal tests with other materials will also be conducted if the proposed oil does not perform satisfactorily in practise. A plan to afford additional relief by adulticing inhabited areas will also be put into effect. Evaluations of different materials, dosages, and effectiveness of this method will be made in conjunction with this spray program.

We are also making plans for a long range program, designed to arrive at a permanent control method, once we regain temporary control by insecticides. Attempts at discovering parasites of the larvae have failed so far. Experiments with commercially available bacterial spores are planned to see if any hope lies in this direction. Fish management is another area of investigation because of the possibility of control by favoring those species of fish that are heavy gnat feeders. Another approach would be permanent control by modifying some of the physical and chemical properties of the lake. This will involve additional studies of the life history of the Clear Lake gnat and an extensive study of the ecological conditions of its various habitats.

Tests involving raising and lowering the surface tension of the water surface will be undertaken also. A test made last summer indicates that hexadecanol, a cetyl alcohol used as an evaporation retarder in reservoirs, interferes with the emergence of adults to some degree, in laboratory tests.

There are also indications that the larvae of the lake have developed some resistance to DDD. It is important for us to know the degree of this resistance and its influence on related and unrelated insecticides before we make another treatment. Tests on this subject are being carried out at present.

Tests using granules for a carrier to get insecticides into the mud have been conducted recently. The promise of any degree of control by this method seems dubious at this stage however, due to the inactivation of insecticides by particles.

The objective of our program is threefold. First: Stop-gap measures to provide temporary relief this year, and years between lake treatments. If effective enough, the time between the expensive lake treatments might be lengthened. Second: We wish to find a replacement chemical for DDD and to reestablish effective chemical control. If we are fortunate enough to find one, we shall endeavor to develop other alternates to be used, when and if problems of resistance or other unforseen problems arise. Lake treatments are expensive and temporary, but they are the only effective control method we have at present. Until we can find a better method of combating gnats it behooves us to use this method to the utmost. Third: We believe it is within the realm of possibility to reduce the gnat population below the level of economic importance and keep them there with a minimum of expense and effort. A long range study of the ecology and life history of the gnat will be carried out before we can arrive at this goal of permanent control.

Mr. Grant: Thank you very much, Mr. Dolphin. It certainly seems that a need for research is here, where so far we have only insecticides and the insects are keeping pretty much ahead of it. But my words are going to run us behind schedule, so at this time I would like to have a summary of the program carried on against the *Hippelates* eye gnat from the southern California area which has been done in conjunction with the Coachella Valley Mosquito Abatement District and the University of California at Riverside by the principle investigator, who is Dr. Mir Mulla, Entomologist from the University of California, Riverside.

SOME IMPORTANT ASPECTS OF HIPPELATES GNATS WITH A BRIEF PRESENTATION OF CURRENT RESEARCH FINDINGS[1]

MIR S. MULLA

University of California Citrus Experiment Station
Riverside, California

Since this is a symposium on the activities of Mosquito Abatement Districts as related to fields of operation other than mosquito control, it will be suitable to make some generalized statements here regarding the scope, extent, and seriousness of the *Hippelates* eye-gnat problem. The nature of the problem as it appears

[1] The work reported here is part of a project supported by the Coachella Valley Mosquito Abatement District.

at the present time causes a great deal of apprehension. Those faced with the gnat threat have shown concern over the future course of this ever-increasing problem. It is this concern which has led to the current, expanded research program formulated by the University of California in cooperation with state and local agencies. Observations and findings within the past three years have indicated eye gnats to be spreading to new areas or becoming a menace in locations where they were not considered a problem previously. This increase in gnat population could be due to either alteration of the environment in favor of the pest or to adaptions of the pest to a changing environment.

At present there are two mosquito abatement districts that are actively engaged in eye-gnat abatement programs. Indications are that two or more other districts might deem it advisable to initiate some control measures in the future within their district limits.

In areas where their population density is above the tolerance threshold of man and animals, *Hippelates* eye gnats are a greater menace to the public than other pestiferous and vector species. This is not an attempt to minimize the importance of other pest and vector species in the area, but to point out the various biological and ecological features of eye gnats that lead to a greater degree of annoyance caused by these pests. This situation could be caused by one or more of the following factors relating to some of the biological and behavioristic activities of eye gnats within a wide range of a heterogeneous environment.

(1) *Hippelates* eye gnats, unlike some other pests (mosquito species, for example), approach the mammalian host without any warning sound.

(2) They usually alight some distance from the feeding site. To get to this site the gnats resort to crawling or to intermittent flying and alighting on or in the vicinity of the feeding site. This type of behavior causes a great deal of annoyance to the host.

(3) After reaching the feeding site, the gnat begins pressing its proboscis into the skin until it finds some mucus or other secretions. If wounds or lacerations are present, the gnat tries to scarify the surface and obtain food.

(4) Most of the eye gnats observed so far have shown a predilection for host areas where the vital sensory organs are located. Eye gnats are greatly attracted to the eyes, mouth, nose, and ears of their hosts and if let alone, will form rings of engorged individuals on the periphery of the host's eyes and mouth. This relationship magnifies the role of these insects in the transmission of certain human and animal diseases.

(5) Adult eye gnats are believed to obtain their nutritional requirements from both plants and animals, with a greater preference for the latter. By utilizing both plants and animals for satisfying their appetite, the eye gnats can be considered the most successful and well-adapted type of pestiferous insect. Information on this phase of the problem is slight, and further investigations should prove rewarding.

(6) The overall population density of the eye gnat in problem areas is greater than that of any other vector species observed. Therefore, the sheer numerical abundance of eye gnats—other factors being equal—would place the *Hippelates* eye-gnat problem at the top.

(7) Factors such as greater mobility, long-distance flight range, and efficient olfactory mechanism give additional advantages to the eye gnats over certain other pestiferous insects.

(8) Eye gnats being terrestrial creatures utilize a heterogeneous type of environment as compared to that of mosquitoes and certain other gnats of aquatic habitat.

(9) In most cases the diurnal activity of *Hippelates* eye gnats coincides closely with human activity. Were the eye gnats active at times other than from sunrise to sunset, their importance as annoying pests would be greatly diminished. As it is, this pattern of diurnal behavior seems to be the most important single factor leading to the intensity of the *Hippelates* problem in infested areas.

Chemical Control Investigations

This phase of the research program was pursued both in the laboratory and in the field. Many of the common chlorinated hydrocarbon insecticides, as soil treatments, were screened in the laboratory against *Hippelates collusor* (Tsnd.), the predominant species of eye gnats in the Southwest. Screening of the organophosphorus and carbamate insecticides as soil toxicants was also initiated. A procedure for evaluating toxicity of various insecticides to the adult gnat was also developed.

Field investigations on the effectiveness of various materials as soil treatments is a long-drawn-out and expensive proposition. A great deal of planning and experimentation is needed before the feasibility of a material for large-scale control program is recommended. However, with the development of laboratory information certain stages of this tedious program can be omitted profitably.

Field trials with the most promising residual insecticides were continued. Some of the organophosphorus insecticides that gave promising results in the laboratory also were subjected to field trials. Certain aspects of these investigations in the laboratory and field will be discussed below.

Laboratory. Of chlorinated hydrocarbon insecticides, aldrin, dieldrin, heptachlor, chlordane, lindane, SD 4402, toxaphene, GC 1189, and DDT were tested. The efficiency of these materials is shown in the following table in which the LC-50 and LC-90 dosages are given for each material.

From the data of table 1, it is obvious that at practical dosages, not many of this group of insecticides have appreciable toxicity against the eye gnats. On the basis of this information, only four of the insecticides, namely, SD 4402, endrin, aldrin, and DDT, should be considered for field trials. Further experiments on the longevity of aldrin (at 8 pounds actual toxicant/6-inch acre) proved this material to lose its initial activity rapidly. Because of its short-term activity against gnats, aldrin does not hold a fair chance for extensive trials in the field.

Very few carbamates have been tested in the soil against eye gnats. Those that have been subjected to trials in the laboratory yielded poor results. At the present time it is not possible to base any conclusions on this meager information. There are many compounds in this class of insecticides which should be thoroughly tested before any conclusions are formulated.

TABLE 1

THE RELATIVE INITIAL EFFECTIVENESS OF CHLORINATED HYDROCARBON INSECTICIDES AS MEASURED BY THEIR LC-50 AND LC-90 DOSAGES AGAINST THE EYE GNAT *HIPPELATES COLLUSOR* (Tsnd)

Material	Pounds Actual Toxicant Per 6-inch Acre LC-50	LC-90
SD 4402	0.8	1.5
Endrin	2.2	4.5
Aldrin	6.5	18.0
DDT	10.0	25.0
Dieldrin	12.0	32.0
Lindane	18.0	35.0
GC 1189	28.0	46.0
Toxaphene	30.0	100+
Heptachlor	50.0	100+
Chlordane	60.0	100+

Organophosphorus insecticides generally showed greater activity against eye gnats in the laboratory. A few of these, such as Co-Ral, Bayer 25141, and Bayer 29493, manifested a high degree of activity. These materials at 0.05-0.20 pounds per 6-inch acre of soil gave 90 per cent or more mortality of the emerging gnats. Korlan, American Cyanamid 18133, guthion, and ethion showed moderate to high activity. Of these materials Co-Ral, guthion, and ethion were subjected to field trials (see below).

The initial activity of DDT granular formulations (10 per cent, 20 per cent, and 35 per cent) was found to be inferior to spray applications. After 3 months' storage of the treated soil, the 10 per cent formulation was just as good as sprays, while the 20 per cent and 35 per cent formulations were still inferior to sprays. A similar trend has been observed in field tests with the exception of the 10 per cent formulation (see below).

Field. Results from plots treated in 1957 with equivalent amounts (cost basis) of various chlorinated hydrocarbons became available during the past season. Among these, DDT at 14 pounds per acre and DDT-toxaphene combination (DDT 9 pounds actual and toxaphene 7 pounds actual per acre) gave 95 per cent and 88 per cent control of *H. collusor* respectively. The other materials (aldrin, dieldrin, endrin, and toxaphene) did not yield promising results. Studies on the effectiveness of these materials are being continued.

Comparison between DDT sprays and granular formulations, when applied at approximately equal dosages in the field, showed the former treatments to be more effective. The results in these trials were obtained about 3 months after treatment of the plots. The spray treatment (16.0 pounds actual DDT per acre) resulted in 97 per cent control of *H. collusor*. The 10, 20, and 35 per cent granular formulations on attapulgite RVM-A, 30-60 mesh (all applied at 15.4 pounds actual toxicant per acre) gave 61, 60, and 49 per cent control respectively.

Ethion spray at 2 pounds actual material/acre resulted in high degree of initial control, while granular formulations at double this amount gave an equal degree of control. With further increase in dosage there was a slight increase in control.

Guthion granules at 4 pounds actual toxicant/acre also gave a good initial control of the gnat. Co-Ral wettable powder sprays in two widely separated tests resulted in good initial control of the gnat when applied at 2 pounds actual material/acre. With further increase in dosages there was no increase or slight increase in response for both guthion and Co-Ral.

Proof of the efficiency of an insecticide in the laboratory and in the field against eye gnats is by no means an indication that the material will be recommended for large-scale gnat-control programs. The promising materials have to be subjected to further critical tests. The accumulation hazard of such materials in the soil and their effect on the equilibrium level of pest and beneficial insects on food and forage crops have to be ascertained accurately. DDT (at 12-15 pounds actual material/acre, for example, has been utilized for large area control experiments. Due to lack of pertinent information on certain aspects of its use, DDT will be recommended for routine use when such information becomes available.

Attractants and Bait Sprays

Attractants. Systematic studies on the screening and evaluation of chemicals as attractants against eye gnats were begun toward the end of the past season. This phase of the work was advanced by designing the CES (Citrus Experiment Station) eye-gnat trap. This is a simple, small trap that has many features to make it suitable for attractant studies. The trap is sensitive and has yielded reproducible results within limits.

Over 90 experiments have been performed since the design of this trap. Some of these tests were performed for improving the efficiency of the trap. Most of the experiments, however, were conducted for the evaluation of attractancy of various materials. Since the trap utilizes a quick knock-down insecticide in the collection vial, some work on the repellency of various insecticides was also accomplished.

Among the proteinaceous substances, solutions or preparations of whole egg powder, egg yolk, egg albumin, lactalbumin peptone, and partially hydrolyzed yeast were highly attractive to the eye gnats (mainly *H. collusar).* Staley's corn protein Sauce Nos. 2 and 7, fish meal, and gelatine were slightly attractive. No tests have been conducted for comparing these materials directly with each other or against a standard material. Therefore, no definite statements regarding the attractancy of each material as compared to others in each one of the above two classes can be made at this time.

The peak attractancy of each material is obtained only when the preparation is aged for a certain length of time. This time interval before a material becomes highly attractive is a function of the temperature at which the material is exposed for aging. Also, concentration of the material might possibly effect the peak attractancy as related to time. This aspect of the problem is not investigated as yet.

Biochemical studies on the attractancy of amino acid mixtures and aged lactalbumin peptone are progressing steadily. These studies are aimed mainly at isolating and recovering the pure chemical substance or a com-

bination of substances which manifest attractancy to eye gnats.

Bait Spray Application. Preliminary tests with bait sprays in two semi-isolated ranches yielded promising results. To avoid residue hazards on food crops and other side effects therefrom, the sprays were applied to weeds and other cover crops where the gnats probably hang around.

In these applications 0.5-1.6 pounds of malathion per acre (based on total test area) gave marked reduction of adult gnat population. Similarly, Korlan at 0.25 pounds actual material per acre (based on total test area) in combination with baits gave appreciable reduction of eye gnats. With both materials the control lasted for 3-4 weeks.

Aerosol Treatments

Studies on the effectiveness of aerosol treatments were conducted early in the season. A Stearman 450-horsepower plane was fitted with a venturi type exhaust tube for the purpose of generating thermal aerosols. The insecticidal solutions were injected into the venturi throat through two No. 6 or No. 15 T-jet nozzles. With this setup, approximately 0.20-0.25 pound of the toxicant was administered to a 1-acre surface area, when a 20 per cent toxicant solution was used. The mass median particle under these conditions measured 25-35 microns.

In one test caged gnats were exposed in various types of cover and plant stand. The plane generating the aerosol flew at an average flight altitude of 30 feet. The kill, as might be expected, was higher under a low-growing plant canopy (table 2).

TABLE 2

MORTALITY OF ADULT EYE GNATS *(HIPPELATES COLLUSOR)* CONFINED IN 40-MESH STRAINER CLOTH CAGES AFTER APPLICATION OF MALATHION THERMAL AEROSOL[a]

Crops Where Cages Set	Avg. No. Gnats/Cage[b]	Avg. No. Dead Gnats	Per Cent Kill[c]
Grapes	35	20	44
Dates	43	22	36
Cotton	47	38	70
Check	50	11	—

Moderate reduction of the gnat population was obtained in the La Quinta area of Coachella Valley, where approximately 1,500 acres were treated with malathion aerosol (0.20 pounds per acre). The gnats were suppressed for only 4-5 days (fig. 1) and population increased rapidly due to influx of gnats from untreated areas.

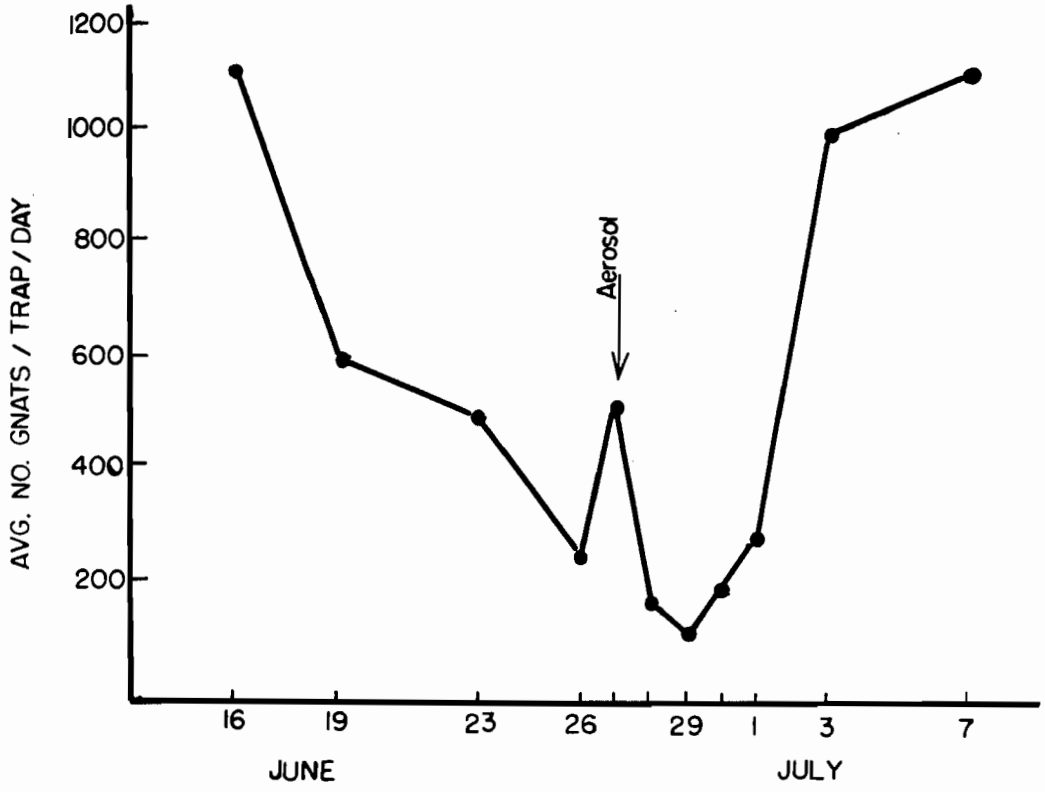
[a] Twenty per cent malathion, 30 per cent aromatic solvent (Shell sovent 42) and 50 per cent diesel oil No. 2. The active material was applied at the rate of 0.2 pounds per 30-ft. acre.

[b] Three cages were set in each location, and two cages were set as controls outside the treated area.

[c] Mortality corrected by Abbott's formula. The kill was determined 20 hours after exposure.

FIGURE 1

Gnat population density prior and after a malathion thermal aerosol treatment in La Quinta area (average of 10 bait traps).



In a similar large-scale aerosol test in the Indio area, greater reduction of gnat population was attained. Malathion 20 per cent solution in aromatic solvent and diesel oil was utilized delivering 0.20 pounds of the actual material per 50-foot acre. The low level of population after the treatment was maintained for a period of 4-5 weeks.

Many factors have to be considered and elucidated in the evaluation of aerosol treatments covering large areas. Climatic factors and inversion conditions from one spot of the test area to another have to be well known. In addition to these factors, type of plant cover, proximity of heavy gnat breeding source to the test area, and pretreatment population levels will undoubtedly influence the efficiency of aerosol treatments.

Mr. Grant: Thank you very much. Dr. Mulla will submit a fuller presentation of this for publication in the Proceedings, and with these tables and so forth, you will probably want some time to fully analyze these problems which are most interesting in the results. Now I will call upon Tom Lauret of the San Mateo County Mosquito Abatement District to give a summary of the study on the Valley Black Gnat, *Leptoconops torrens.* Tom Lauret.

VALLEY BLACK GNAT *(Leptoconops torrens)* RESEARCH PROGRAM

H. E. MUNSTERMAN, T. H. LAURET and C. D. GRANT[1]

The San Mateo County Mosquito Abatement District has previously conducted a restricted study program for three years on *L. torrens* on a local basis. In the current fiscal year (1958-59) this program was placed on a wider basis through matching research funds provided by action of the State Legislature and administered by the State Department of Public Health.

The Gnat and the Problem

The Valley Black Gnat is a tiny representative of the Heleidae (about 1⅛ mm. long), biting man and other mammals near divers locations of adobe soils scattered throughout the temperate lowlands and foothills of the western United States. Previous studies have shown that this gnat normally undergoes larval development in adobe soils at a depth of one to three feet, probably under anaerobic conditions. Egress is afforded by deep fissuring of such soils affording seasonal emergence (normally late May to mid-July), but the ability of the larvae to undergo a diapause state and the lack of direct observations or rearing of the larvae leave several questions as to its normal period of larval development and potential longevity. The adults appear to survive for only a few days at most.

The interspersed emergence of adult gnats from a given soil source over a period four to six weeks creates a season of adult prevalence under normal circumstances of six to eight weeks. The bite of the female of *L. torrens* produces an intensely irritating and prolonged reaction in humans which may show considerable variation with the sensitivity of individuals. The severity of the bite is such, however, that even moderate infestations may serve to curtail most outdoor activity where they occur and often cause workmen to leave their jobs for two or three weeks.

Although San Mateo County has only limited sources producing these gnats, the highly residential character of this District and desire for outdoor living by the public has created a strong demand for control measures against *L. torrens.* As California's growing population has moved into new areas elsewhere in the State, many new residential sections have become acutely aware of endemic black gnat populations, not only around the coastal valleys but the Central Valley and up to 3,000 feet in the Sierra foothills *(L. torrens,* not *L. kerteszi).* Larval sources in the Sacramento Valley appear to be very extensive in some areas and with increased population density and military installations developing in such areas, the problem is becoming increasingly acute.

Thus far experimental insecticidal control of the adults has yielded a minimum of effectiveness within practical treatment levels. Some techniques for treatment of the soil with insecticides have indicated that effective kill of the adults may be attained at the source of emergence, but such methods are not the most practical for an extensive control program. With so many unknowns and obvious problems in control, it has been deemed most essential to determine at least many basic answers concerning the ecological factors governing the behavior of this gnat so as to provide reliable reference points in developing either ecological or insecticidal control procedures that may lead to a permanent solution of the problem. It is toward this end that the current year's program is primarily directed.

Program Objectives

The current program has provided for a full time biologist with part time entomological and field services and some added facilities. A year around research program is highly desirable, since it is felt that the biology of *L. torrens* is closely associated with the total annual picture of climatic and soil condition factors. Since earlier work by this District has established an apparently high correlation between certain soil formations and positive gnat producing sites, as determined by the simplified method of taking soil cores, a good portion of our program has been directed toward verification of this correlation and analysis of several basic factors affecting the ecological relationships within such positive soil habitats in contrast to those of nearly similar soil formations which have been demonstrated as negative for gnat production. Adequate sampling, trapping and soil analyses are planned to be conducted to provide for reliable statistical analysis of the various factors under study. At least some work in other facets of study are necessary to guide, interpret and supplement the research on larval ecology.

Planning

In reviewing the work of previous investigations and published information, it was felt that a background of

[1] Biologist, Entomologist and Manager-Entomologist respectively for the San Mateo County Mosquito Abatement District, Burlingame.

data on the basic physical and chemical factors pertinent to the larval habitat was necessary for developing successive approaches to control methods. Especially in view of the time and budget limitations, study factors were selected for their value in guiding current and subsequent testing of hypotheses of larval ecology and development. (This, in lieu of mass data on all of the possible biological factors influencing survival of *L. torrens.)*

The location of the larval habitat, 1-3 feet below the surface, posed some preliminary problems in choosing and developing equipment and techniques that would prove feasible under extensive use in such subsequent studies.

To meet the program objectives, both field and laboratory techniques were evaluated and streamlined to secure the information desired.

Securing an appropriate site for a suitable test area, where all factors concerned could be observed throughout the year, involved a review of all test sites used in previous years.

Selection entailed an examination of soil cores, temperatures, accessibility of terrain and freedom from outside interference. The test area is being divided into plots to include particular soil types in adjacent areas so that a comparison may eventually be made of many related physical and biological factors in gnat ecology.

With extensive coring and trapping it is hoped that a definite correlation between specific soil factors and black gnat presence, whether in the coastal valleys or elsewhere, may be established through analysis of the resulting data on an adequate scale and that this correlation may be determined by macroscopic examination in the field.

Facilities and Equipment

To adequately cope with the increased work it was necessary to expand the district's laboratory space and secure additional laboratory equipment. Laboratory space was designed for the storage of soil samples and normal soil analysis equipment necessary in determining soil moisture content, pH, calcareous material percentages, and amount of organic matter present. These determinations will be made on all soil horizons concerned. Additional glassware and chemicals have been purchased and several items of equipment were borrowed so that the analytical work could be carried out in accord with critical standards and thus avoid any question in this regard.

Various types of equipment were employed to secure soil samples at different depths. The closed spiral auger of 2" diameter and split tube sampler were found to be most efficient in procuring adequate soil samples for analysis. The samples were stored in suitable glass containers with special polyethylene lid liners to insure complete moisture retention.

To better ensure entrance and exit to the study areas with the necessary soil equipment, a 1958 Dodge four-wheel drive Power Wagon was purchased in August of last year.

A review of available literature on soils and analytical methods served to improve our knowledge of soil types and efficient soil test procedures. Specific books and pamphlets were purchased in order that the district could maintain a practical reference section for the work in progress.

Taxo-morphological Studies

Specimens of adult *L. torrens* were examined from all the positive sites and other collections within the District and adjacent areas. These were compared with specimens collected from other areas about the State, and detailed morphological drawings are in preparation which will be published at a later date. The specimens, whether from the Coastal Valleys, the Sacramento area, the Sierra foothills or elsewhere thus far do not demonstrate significant morphological variation.

Study Site:

The new test area selected for extensive analysis is located in a tract of land owned by Stanford University and leased as pasture by a local dairy. The test site is roughly the shape of a trapezoid approximately 135,000 sq. ft., and encompasses dark, gray, heavy clay soils in the center with lighter, brown clays at the perimeters. This area has been staked every 20 feet on each side and soil samples are being taken at these points to determine the depth of soil horizons on side slopes and the center draw as well as temperature, and moisture content samples.

During the gnat emergence period the test area will be trapped extensively on the various soil types. In addition, several pits will be dug in an effort to locate larvae and possibly pupae for rearing under anaerobic conditions in the laboratory. Smith and Lowe (1948, p. 174)* mention that the larvae undergo hypermetabolism followed by death possibly due to the relatively high oxygen content of laboratory media, in contrast to the extremely low oxygen content of clay soils at depths of 2 feet or more.

Mr. Grant: Thank you, Tom, for your brief summary. I was wondering if we might take the liberty of a small stretch. We have two papers yet for presentation, on weed control and an educational approach. What are your wishes on that Gordon? Maybe we had better put a rope around outside. All right, we'll stand up and take a short stretch.

(Recess)

Mr. Grant: Gentlemen: the meeting will come to order. We will continue with our talks in finishing up this symposium on other activities of mosquito abatement agencies. I would like to call at this time upon a substitute speaker for Mr. Greenfield on the subject of Weed Control Developments and Uses by Local Mosquito Abatement Agencies, Mr. Merrill A. Wood, Entomologist for the Northern Salinas Valley Mosquito Abatement District.

Mr. Wood: Thank you, Mr. Chairman, ladies and gentlemen, members of the Association. I am very sorry that Mr. Greenfield was unable to be here to present his talk this afternoon. I hope you will bear with me while I read it.

* Smith, Leslie M., and Homer Lowe, 1948. The Black Gnats of California, Hilgardia, Univ. of California at Berkeley; Vol. 18, p. 174.

WEED CONTROL PRACTICES BY LOCAL MOSQUITO CONTROL AGENCIES

HOWARD R. GREENFIELD, *Manager-Entomologist*

Northern Salinas Valley
Mosquito Abatement District

Weeds have long been known to seriously reduce the productivity of farm lands and in many other ways interfere with man's efforts to produce useful plants. From the very beginning of man's attempts to grow his food, weeds have had direct effects on his efforts, resulting in: reduced yields, increased labor costs, the poisoning of his animals, and, lastly, a threat to his health and general well being.

No individual, or business concern, can truly escape the effects of weeds. We may learn to live with them, but we cannot escape them.

In mosquito control we are not concerned to any great degree with the problem of weed growth on agricultural lands. We are, however, concerned with weed growth when it influences our activities in mosquito control. Observations made by Districts that have embarked upon a source reduction, source modification, or source elimination program, indicate that aquatic weeds, both submerged and emergent, and the closely related problem of weeds which grow at the waterline or on wet lands, are likely to create habitats suitable for the production of mosquitoes.

In their attempt to control the mosquito producing sources, a number of Districts have constructed holding ponds for used irrigation waters; and, in so doing, they have provided a habitat for vigorous stands of weeds. The weeds, in turn, usually increase the productivity of the mosquitoes and hinder the use of chemicals (larvicides). Doesn't it seem advisable, then, to consider weed control as an important factor in the design of a holding pond? I know, in many Districts, the problem of controlling mosquitoes in dairy and irrigation drains plays an important part in their operational plan; and, to increase the effectiveness of the larviciding materials, these Districts have resorted to the limited use of weedicides.

I believe that we can use the Northern Salinas Valley Mosquito Abatement District as an example of how a weed control program can be made a part of a District's operational plan.

In 1952, the Board of Trustees met with representatives from the City of Salinas and the County of Monterey to discuss, specifically, the Reclamation District #1665. This District, formed in 1917, had, by 1920, constructed twenty miles of main canal and nineteen and one-half miles of laterals. By 1950, the Reclamation District, having paid its bond obligations, was not interested in actively pursuing a maintenance program for the drainage system. Consequently, aquatic and ditch bank vegetation quickly reduced the carrying capacity of the drainage system, which, in turn, provided almost unlimited sources for mosquito production along the entire length of the canal. Attempts by the Northern Salinas Valley Mosquito Abatement District to control the mosquitoes, through the use of larvicides, was only partially successful and it proved to be an economic burden on a very tight budget. Thus, when the representatives from the three agencies sat down to discuss the Reclamation District problem, they were all in agreement as to the need of a complete maintenance program; however, they were undecided as to the questions of responsibility and fields of interest. Needless to say, the County and City representatives eventually were able to induce the Trustees of the Mosquito Abatement District to accept the responsibility of providing a continuing maintenance program for the Reclamation District Canals. This delegation of responsibility was based on the direct interest that the District had in providing mosquito control on a sound economical basis.

During the years that followed the acceptance of the defined responsibilities, the Mosquito Abatement District was forced to acquire additional equipment. This District now has two D-4 Caterpillar tractors, one Link Belt, 5/8 cubic yard dragline, a pull grader, two carryalls, a District designed Propane-Butane Weed Burner, and weed sprayer rig. In acquiring the heavy equipment, the Trustees of the Northern Salinas Valley Mosquito Abatement District realized that they were embarking upon a source reduction program which would eventually include an organized weed control program.

When a District has entered upon a source reduction or source elimination program, fitting weed control into an established operational mosquito control program is not difficult and it certainly can be justified both legally and economically. Legal authority, to include weed control into a mosquito abatement program, can be found under Section 2270, paragraph C, of the Health and Safety Code of the State of California. In essence, this Section permits the Board of Trustees to "take any and all steps necessary to control or eradicate mosquitoes." In our opinion, this can mean weed control or any other technique which would provide mosquito control.

Another question which we had to answer was—would we be duplicating work that other agencies were perhaps better able to perform, or work that they were obligated to perform? In our County, we found the Road Commissioner's Office doing extensive weed control along their right-of-ways, the Agricultural Commissioner's Office either controlled or directed the control of noxious weeds on agricultural lands, farmers carried on weed control practices on productive agricultural lands as a general farm practice; but, no agency was inclined to accept the responsibility of providing weed control on natural and man-made drainage systems, marsh lands, or other water impoundments. Thus, it was concluded, that if the District did enter the field of weed control, no spheres of influence would be violated.

An additional factor, but an important one, that had to be considered was cost. Our records indicated that the mechanical cleaning of a given drainage canal would cost between $208.00 and $546.00 per acre, (20 foot top width and 2600 foot length equals approximately one acre). What would be the cost of weed control? After two years of actual cost figures being developed by the Northern Salinas Valley Mosquito Abatement District, weed control amounts to between $32.00 and $120.00 per acre, including four applications of herbicides. Thus, the cost figures given by the chemi-

cal industry are quite accurate and do provide an excellent guide for determining the per acre cost of the herbicides or weedicides presently on the market. This also provides the District Manager with a convenient measuring stick for budget purposes.

Up to this point I have mentioned "why" and "how" a mosquito abatement district could become involved in weed control activities. Now, I would like to mention briefly the actual benefits we have noted during the two years we have operated a full scale weed control program:

1. Reduced larviciding time
2. Increase in number of sources inspected
3. Reduction in amount of larviciding chemical purchased
4. Reduction in number of sources
5. Greatly improved public relations and public participation
6. Definite stimulation of cooperative source reduction projects
7. Reduction of local flooding in years of excessive rainfall
8. Increased land values through improved subdrainage of lands adjacent to drainage systems.

These are just a few of the benefits this District has gained.

Before I close I would like to say that the problems encountered in establishing a functional weed control program by this District do not vary appreciably from other Districts, and it has provided us with one more tool to use in our efforts to control the common enemy—the mosquito.

Mr. Grant: Thank you, Bob. The last paper on this symposium is possibly very closely associated with mosquito abatement activities in its take-off; however, it is probably a practice which could be utilized and developed in many of the aspects or other types of work which mosquito abatement districts may fall heir to. Several weeks ago, Jack Kimball circulated a folder, or bound pamphlet by the local schools for teaching their children about mosquito abatement work. It was developed by the educational facilities in their county and looks like a wonderful opportunity for others to follow. I wonder if Jack can elucidate more upon this and some of its potentials. Here is Jack Kimball, Manager of the Orange County Mosquito Abatement District.

Mr. Kimball: I don't know if I can elucidate, but I can talk upon it. I am going to read it because I know I will stick to the subject if I read it rather than wandering around.

AN EDUCATIONAL APPROACH TO MOSQUITO ABATEMENT VIA SCHOOL CURRICULUM

JACK H. KIMBALL

District Manager, Orange County Mosquito Abatement District

For presentation at the 27th Annual Conference of the California Mosquito Control Association, Inc., at Monterey, California, February 2, 1959

Each Monday morning five batches of mosquito larvae are whisked away to school to complete their metamorphosis in the classroom. These mosquitoes are raised in the laboratory of the Orange County Mosquito Abatement District and are made available to all Orange County schools on request.

Through the ages, man has looked in vain for some useful purpose for the pestiferous and sometimes deadly mosquito. This year, however, the Superintendent of Schools of Orange County. Mr. Linton T. Simmons, recognized the mosquito as a very useful teaching aid, and authorized the publication of Community Resource Guide No. 1, "Mosquito Abatement." This Guide was prepared by Miss Evelyn Ericson, Consultant in School Nursing for the Orange County Schools, and is the first of a series of small learning units prepared to acquaint students with community resources. Several copies of this Guide have been made available to each of the 207 public schools in Orange County. There are 178 Elementary Schools, 10 Jr. High Schools, 16 High Schools and 3 Jr. Colleges. Total student enrollment within Orange County Schools is currently 143,349, of which 98,731 are in the elementary grades.

The office of the Superintendent of County Schools has prepared this Guide as a teaching aid. The purpose of the Guide is stated as follows:

I. To teach students facts about mosquitoes.

II. To acquaint students with community resources, particularly in this unit with the local Mosquito Abatement District.

III. To inform students of the world wide problem of the mosquito as a vector of disease.

The Guide lays out a plan of teaching activities which can be integrated with the science program, with language arts, with the health program, and with the social studies. Materials, pamphlets, and films that will help the teacher are described, and information on their availability is presented.

The Orange County Mosquito Abatement District has established a permanent program to furnish any school in Orange County with a specific set of materials, which we call a "Mosquito Study Kit." The kit is designed to conveniently transport the live specimens of mosquito egg rafts, larvae, pupae and adults, as well as mosquito fish. It is also designed so that live specimens can be observed in the classroom without fear of letting an adult mosquito escape. A tripod magnifier and 5 m. beakers are provided to permit close observa-

tion of individual live specimens. In addition to the mosquito specimens, the District also provides a 10 minute film "The Mosquito" by Encyclopaedia Britannica Film, Inc., and a packet containing the following reference material:

(1) Bulletin No. VC-1 "Mosquito Abatement in California." Issued by the Bureau of Vector Control, State Department of Public Health.

(2) Circular 439 "Mosquito Control on the Farm" by University of California Extension Service.

(3) Four 8½" x 11" charts showing egg raft, larva, pupa and adult mosquito, all enlarged about ten times and giving pertinent facts and figures. These charts were prepared by The Orange County Mosquito Abatement District and may be kept by the teacher if desired.

(4) Fifty leaflets describing the Orange County Mosquito Abatement District. These leaflets are for the students to take home.

The District has prepared five of these Mosquito Study Kits for loan to schools for periods of one or two weeks, as desired. The kits are delivered each Monday morning and picked up each Friday afternoon by our District Inspectors. Arrangements have been made with the Audio Visual Departments for the teachers to make reservation directly with our District Office. In this way the teacher can get the live specimens, the film, and reference material from one source.

Our District feels that the time and effort required to provide this service throughout the school year is very worth while. Although it may be impossible to evaluate the results of our efforts, we are confident that the students who have been exposed to the life cycle of the mosquito will be aware of their civic duty to recognize and prevent mosquito breeding wherever they may live.

Mr. Grant: Thanks very much, Jack. Unfortunately this won't work in the central valley. If they lay their eggs Sunday night, on Monday they are going to be adults. It's such fun heckling Jack; every knock is a boost, he turns it right around. I think it's wonderful that you can take a device like this and let everybody else know how good your district is.

I want to thank all of our speakers very much for the considerable amount of time and preparation in these papers, and I thank the audience for their indulgence. Now I would like to turn it back to Gordon Smith.

Pres. Smith: Well, we have covered a lot of territory this afternoon. I think the first two speakers gave cause for thought and maybe some nightmares. The rest of them were also very interesting.

The next item on the program is also a symposium on a topic that is always of interest to mosquito abatement personnel, and that is Inter-Agency Cooperation. I will call on Chet Robinson to take over.

SYMPOSIUM

INTER-AGENCY COOPERATION

Moderator: Chester E. Robinson

Speakers: Robert T. Durbrow

Louis J. Ogden

Richard F. Peters

Chet Robinson: Thank you, Gordon. You know we always like to kid Jack. Now I have finally found out what is going on. We have always called his the Country-Club Mosquito Abatement District, and we wondered what he did with all of his time—trying to find a few larvae! Are these eggs from Southeast? Is that where you get them? I know I haven't sent you any lately.

You know, Northern Salinas Valley kind of outdid themselves in arranging this beautiful weather for us, and in doing so they must have done themselves in, because the manager got chickenpox and we had to take over on the arrangements here. I think it even ran up to Berkeley, because Frank Stead seemed to get some kind of bug. His secretary phoned this morning and said that he couldn't be here; however, we have some very excellent speakers on this symposium. Robert Durbrow, Executive Secretary of the Irrigation Districts Association, will now give his discourse on Cooperation. From previous speakers we have had information on cooperation and I believe the man representing many million acres of irrigated rice and pasture is just the man that we want to have talk to us now. Robert Durbrow.

Mr. Durbrow: Thank you, Mr. Robinson. I am sure that what I have to present could be much better said by someone else. I thought maybe I had better write some of these things down because they may not stand the light in extemporaneous talk. But I would just like to give you a couple of minutes of general background of this subject, and then a survey that we made as to inter-agency cooperation between our people and you people.

The title assigned to this panel is pretty much self-explanatory and indicative of a condition to be desired and worked for by all of us. We wonder, however, if all of us would define "interagency cooperation" in just the same manner. In trying to define the phrase, it seems to me the definition should be something like this:

> "The voluntary coordination of agencies for the best performance of the objectives of each."

There is a tendency to add "for the greatest good to the community" or some such words, but I think that we must assume that, if each agency accomplishes its objectives with due consideration to the objectives of other agencies, the community will be served at a high level. Perhaps we ought to make sure that when I speak of agencies you know what I have in mind. I think of an agency as the result of the desires of a group of people. The pioneer who whittled his domain out of the

raw wilderness was apt to be his own health department, his own sanitary district, as well as his own mosquito control, school, irrigation, drainage and flood control district—and eventually probably even his own cemetery district. It is only the complications of living in a more crowded society that gives us any excuse for agencies, and certainly the people who pay the bill are getting something less than their money's worth if there is not complete interagency cooperation.

If cooperation has to begin from scratch (and it shouldn't have to), it seems to me there are about three stages of the development of the most desirable situation. One stage would be the exchange of information both ways between agencies with a job to do in any community. This exchange can begin without even knowing who is in charge of another agency and should, for the agency making the first overtures, indicate the objectives and enough detail to show where its operations might dovetail into or conflict with that of the agency being contacted. It should offer to discuss the programs of the two agencies and invite a response in the same vein. Another step, and it may come first, is the getting acquainted with personnel of other agencies in the community. This is most valuable and should be encouraged by the heads of all agencies. You may know of instances where agency personnel have been told not to waste time visiting with personnel in other agencies, but I believe that, if the objective is to know the other fellow and his problems, purposeful visiting is far from a waste of time and frequently is the very basis for working out difficult problems affecting each agency. The third step is that of coordinating the programs of two or more agencies to the mutual advantage of all. This is the final objective in interagency cooperation and a basic requirement for accomplishment of the greatest service to the community.

Recently I asked our 185 member agencies to report instances of interagency cooperation, with particular reference to mosquito control, and received some interesting replies. By far, the greatest number indicated a fine working relationship with mosquito control agencies.

From Alameda County the report was ". . . continuous wonderful cooperation," with five instances in detail.

From Merced County: "We remember of no time when the two districts (Merced Irrigation District and the Mosquito Abatement District) have not worked together harmoniously," and the report quoted from two letters from the manager of the M.A.D. thanking the district for its cooperation.

From San Joaquin County we have one report of several instances in which an irrigation district and the mosquito control agency had found it "possible and feasible" to work out their problems, and two reports indicating that public relations and cooperation could be improved.

From Stanislaus County the report is that "our relationship with the Eastside MAD has been very fine," with several instances of mutual cooperation cited.

From Solano County we have a statement that "the working relationship has been quite good."

From Santa Clara County and San Diego County there were reports of cooperation with the County Health Department, with several instances of coordination of effort between the county and the districts.

From Imperial County, we have a report of mosquitoes but no mosquito control agencies, and from Ventura County a report that they are not pestered with either the mosquitoes or the control agencies.

In two instances involving four counties, irrigation districts that cross county boundaries complained that there did not appear to be full coordination of effort between the mosquito control agencies in adjoining counties. This would remind us that a cardinal principle of interagency cooperation is that the cooperation and coordination of effort between like agencies is at least as important as inter-agency cooperation on a broader scale.

If time permitted, we could cite in detail some of the instances of cooperation between our irrigation districts and the local mosquito abatement districts, and perhaps some of these can be brought out in the question period. Suffice it to say here that, in the fairly narrow interagency field of irrigation districts and mosquito abatement districts, cooperation is at a high level in most cases, with continued improvement in all instances our goal and, we hope, yours too!

Mr. Robinson: Thank you, Mr. Durbrow. While we have this man here with millions of acres of irrigated land, are there any questions? Apparently not. You have covered your subject well in the time.

Louis Ogden, of the U.S. Public Health Service, would you please come up here and give us the Federal angle on how we can all cooperate together. Louis Ogden.

COOPERATION BETWEEN FEDERAL AGENCIES (WITH REFERENCE TO MOSQUITO PROBLEMS ASSOCIATED WITH WATER RESOURCE DEVELOPMENTS)*

LOUIS J. OGDEN

Biologist
Communicable Disease Center, Public Health Service
U.S. Department of Health, Education, and Welfare, Greeley, Colorado

For many years various Federal agencies have been concerned with the development and utilization of the water resources in the United States. The major agencies concerned include the Corps of Engineers, Bureau of Reclamation, Soil Conservation Service, Bureau of Indian Affairs, Bureau of Land Management, Geological Survey, National Park Service, Fish and Wildlife Service, Public Health Service, and the Federal Power Commission.

In the early years, water resource projects were de-

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veloped primarily for a single purpose such as irrigation, flood control, power, navigation, or recreation. As time passed, it was recognized that multipurpose programs for the development of water resources must be undertaken in order to provide maximum benefits to the greatest number of people.

During the early 1940's, several Federal inter-agency committees on water resources were established. In 1948, a commission was appointed by the President to study problems relative to development and utilization of water resources. The commission submitted its report to the President in 1950, This report, entitled "A Water Policy for the American People," outlined a comprehensive program for planning, developing, and using water resources on a coordinated basis within the nation's major drainage basins. More recently, on May 26, 1954, the President established a "Cabinet Committee on Water Resources Policy" to begin an extensive review of all aspects of water resources policy. The Secretaries of Interior, Defense, Agriculture, Commerce, and Health, Education and Welfare, and the Director of the Bureau of the Budget make up this committee with the latter three being *ad hoc* members. At the same time, the President also approved an "Inter-Agency Agreement on the Coordination of Water and Related Land Resources Activities." This agreement provided for the replacement of the "Federal Inter-Agency River Basin Committee" created December 29, 1943, by an "Inter-Agency Committee on Water Resources." Membership in this new committee consists of representation at the Secretary, Under Secretary, or Assistant Secretary level from the Departments of the Interior; Agriculture; Commerce; Health, Education, and Welfare; the Army; and the Chairman or a member of the Federal Power Commission. The Department of Labor is an associate member. The major responsibility of the Committee is "to establish means and procedures to promote coordination of the water and related land resources activities of the member agencies." Inter-Agency Committees (commonly referred to as River Basin Committees) which have been established at the field level include: (1) the Missouri Basin Inter-Agency Committee established in 1945 and re-chartered November 16, 1954, (2) the Columbia Basin Inter-Agency Committee organized March 26, 1946, (3) the Arkansas-White-Red Basins Inter-Agency Committee established June 12, 1950, and re-chartered June 14, 1955, (4) the New England-New York Inter-Agency Committee formed October 27, 1950, which was changed on February 25, 1957, to the Northeastern Resources Committee, and (5) the Pacific Southwest Inter-Agency Committee established January 25, 1955. The State of California is represented on this committee. These committees, which are made up of representatives from State and Federal agencies, provide a means for active representation of local groups and individuals. In addition, representatives of State health departments are usually represented on these committees. Through these inter-agency committees, considerable progress has been made in coordinating and integrating the interests of the various groups and agencies into the planning, development, and utilization of water and related land resources.

In the past, water resources developments have created varied types of public health problems, particularly with regard to stream pollution, water supply, and vector control. Experience has demonstrated that many of these problems could have been avoided if the public health aspects had been properly integrated and coordinated with the other interests associated with these projects. The control of these problems has frequently involved tremendous expenditures of public funds. In view of this, most Federal agencies now recognize the desirability of planning for the elimination or prevention of potential public health problems during the development stages of water resources projects. As a result, these agencies are now cooperating on integrating public health interests into the overall plans for water resource development projects. The Public Health Service is responsible for providing other Federal agencies with recommendations for the prevention and control of public health problems associated with Federal water resource projects. The Bureau of Vector Control, California State Department of Public Health, has recognized a similar responsibility for prevention and control of mosquito problems associated with water resource developments within the State. To carry out this responsibility, the Bureau of Vector Control has assigned an entomologist full-time on water resource activities in the State.

AREAS OF MUTUAL INTEREST

Areas of mutual interests are primarily concerned with two water resource developments:

(1) Water improvements of various types

(2) Irrigation

With regard to impoundments, the type of storage reservoir used to impound irrigation water usually does not create serious mosquito problems, but multipurpose reservoirs may create extensive mosquito-producing areas. Impoundments of lesser magnitude, but which create serious mosquito problems, include sewage oxidation ponds, fish and wildlife ponds, recreational lakes, farm ponds, log storage ponds, municipal and industrial water supply reservoirs, and flood control prevention reservoirs.

Man-made impoundments vary in size from small farm ponds of an acre or less to large reservoirs covering many square miles. Mosquito-producing habitats found associated with impoundments include emergent vegetation and/or floating debris in shallow water areas which are protected from wave action; undrained depressions, sloughs, marshes within the summer fluctuation zone; and borrow areas. In addition, rising or constant poor levels that result in water remaining in marginal vegetation for extended periods during the mosquito-producing season may produce areas favorable to extensive mosquito propagation. In general, effective basic mosquito prevention and control measures have been developed for large impounded water projects. The recognized reservoir preparation and maintenance procedures need to be refined and modified as necessary to keep pace with advances in control technology and for better integration of mosquito control with various other interests such as fish and wildlife, water storage, power, and recreation on multi-purpose projects.

Waterfowl refuges and shooting grounds for waterfowl (both public and private) may be responsible for

creating serious mosquito problems that can be solved only by inter-agency cooperation. Important mosquito-producing areas in refuges and shooting grounds are usually the heavily vegetated lands subject to shallow inundation. The flooding may be permanent or temporary. Of especial importance are the undiked areas on the landward sides of waterfowl developments. However, studies have shown that wildlife management practices coordinated with mosquito control interests can do much to benefit wildlife and prevent mosquito production.

In certain sections of the United States, such as the Dakotas, California, and Texas, sewage stabilization ponds are used extensively as a means of sewage treatment. Studies of these ponds have shown that they can create serious mosquito problems, particularly when shallow margins are not kept free of protective vegetation.

Similar mosquito problems can arise where municipal sewage effluent is utilized for irrigation or fish and wildlife developments. Ponded sewage effluent on pastures and undeveloped low-lying lands can produce tremendous numbers of mosquitoes. There is no reason to have mosquito production associated with municipal sewage effluent if agencies in charge of sewage disposal will incorporate mosquito control into their planning.

Log ponds create an unusual type of mosquito control problem in the Pacific Northwest. These ponds, which vary from a fraction of an acre to 100 or more acres in size, are polluted with varying amounts of organic extracts and debris from logs that are passed through or stored in them. These ponds frequently produce tremendous numbers of *Culex tarsalis, Culex peus, Culex pipiens, Culiseta incidens*, and where pond margins are overgrown with cattails, *Mansonia perturbans*.

Since the passage of Public Law 566 in August 1955, literally thousands of applications have been received by the Soil Conservation Service for assistance in constructing watershed protection and flood prevention reservoirs. Only rarely do these reservoirs hold water long enough to produce mosquitoes, but it is important that they be properly designed to prevent creation of undrained marginal pools that could create severe mosquito problems.

Irrigation

Irrigation is one of the greatest and most important areas of mutual interest to Federal agencies concerned with water resources developments. Ordinarily, irrigation storage reservoirs do not create serious mosquito problems. The normal water releases for irrigation usually result in a drawdown that keeps the water below encroaching marginal vegetation, thereby providing a clean shore line that is unfavorable for mosquito production. The major mosquito sources associated with irrigation may be grouped into 3 principal categories: (1) those related to water conveyances (irrigation canal and laterals); (2) those related to the application of water on the land (farm irrigation); and (3) those related to the removal of excess water from the land (drainage).

With regard to canals and laterals, seeps are the most important mosquito-producing habitats. Where unlined canals are used, large amounts of water are frequently lost by seepage through the earth beds and banks. These losses, together with those resulting from deep percolation from irrigated lands, often result in marshy seeps, that are highly favorable mosquito-producing habitats, especially for *C. tarsalis*, the principal vector of viral encephalitis in the West.

The manner in which irrigation water is used on the farm is highly important with regard to creation of favorable mosquito-breeding areas. Mosquito production on irrigated fields has been found to occur most often on those used for pastures and hay meadows or other close-growing feed crops. As a result of poor soil and water-management practices, water is frequently ponded on these fields long enough to produce mosquitoes. It has been shown that adequate preparation of land and proper water usage results in (1) increased crop production with direct monetary benefits to the farmer and (2) prevention of mosquito production.

Improper disposal of waste irrigation water is a major cause of mosquito production. Important sources of mosquitoes may occur in varied aquatic habitats outside of irrigated fields, for example on undeveloped low-lying areas and waste lands, roadside ditches, and borrow pits that are flooded by excess irrigation. These off-field habitats are generally directly associated with inadequate farmstead or trunk drainage or both.

CURRENT NEEDS

The wide scope and variation of the foregoing examples of mosquito problems associated with water resource developments clearly show the need for cooperation among Federal agencies if progress is to be made in eliminating or preventing these problems. It also follows that this cooperation must include State and local agencies in order to most effectively combat these mosquito problems.

Mutual Understanding and Cooperation

A mutual understanding of each other's problems and a wholehearted effort to solve these problems for the best interest of all is one of the major current needs. The construction and operating agencies are frequently completely unaware of the mosquito production potentials of projects and how to eliminate these potentials. Likewise, mosquito control people are frequently unaware of the limitations placed on construction and operating agencies by the primary function of the projects. Frank discussions of the problems will frequently result in the incorporation of control procedures in the construction and operation of water resource projects to the mutual benfit of all concerned.

Cooperative Research

Cooperative research from a multiple purpose viewpoint is a second important need. This type of research is actually the logical outcome of a cooperative approach to the problems associated with water resource developments.

Integration of Interests

A third need is that of integration of various interests in the development and utilization of water resource projects. It is extremely important that the various in-

terests of cooperating agencies be integrated into water resource projects during the planning and construction phases rather than as an afterthought when the projects are constructed and in operation.

Financing

Two needs exist with respect to monies for vector control in development and utilization of water resources: (1) adequate funds to incorporate vector control procedures in the planning and construction of individual projects, and (2) adequate funds for carrying out necessary vector control activities during the operation and maintenance period following construction of the projects.

Mr. Robinson: Thank you, Louis. Are there any questions that you would like to ask of this representative of our Great White Father here? If not, we will continue with our program. I am rather proud of the way that our first two speakers went at this.

I have an unfortunate announcement to make at this time. The next speaker I have always classed as a very great friend of mine, and we have chatted back and forth, and our families have visited back and forth. I happened to be in here today and he mentioned something to the effect that mosquito abatement districts would some day take on fly control and our friendship has ceased; so I put him at the end of the program, and I won't even introduce him to you. He is the substitute speaker for Frank Stead. (Dick Peters.)

Mr. Peters: I invite you to be sympathetic. This morning when I awakened after not having retired for very long, I received a telephone call from Berkeley. It was Mr. Stead's secretary and she said, "Mr. Stead asked me to ask you to appear for him on this panel and give his talk." Well, I came down here without his talk, so I am not very well equipped to give his talk. Nevertheless, I will attempt to reflect upon a subject which has been a point of philosophy with me. Before doing so, I must carry my dilemma a little bit further by telling you that upon receiving this word I immediately began searching for ways and means of fulfilling my responsibility. One doesn't let his boss down lightly; he must at least make a gesture toward doing the thing he thinks his boss would have done. So, in desperation I looked into my brief case, wondering why I had been carrying such a voluminous thing around so long, and, lo and behold, I chanced upon a very brief presentation I once made in New Jersey. And, of all things, it pertains to interagency cooperation and identifies the role that mosquito control could play. This presentation was made seven years ago. Seven is a natural, so naturally, I intend to make the most of it. Since few of you heard it then and, of course, none has read it, please bear with me and I'll be through before you realize. It is entitled "The Path of Least Resistance in California Mosquito Control." Mind you, this was written back in the early fifties, and we had just begun to experience insect resistance. I purposely used this title then because it gave me an entre. If Dr. Hoskins feels that I am going to intrude upon his subject, I shall not, for I am not going to even talk about insect resistance–only how to circumvent it. (Vide: Peters, Richard F. 1952. The path of least resistance in California mosquito control. *Mosquito News* 12(2): 79-80.)

As I reviewed this today, I put myself on trial in a way, because one wonders whether over time he is changing his concepts, his viewpoints; however, deep down inside I still believe it. So I leave you with a second hand presentation of this paper, and I hope you agree that the message contained, even though it has only been gradually infiltrating abatement practice, remains a sound direction to move toward. In concluding, I repeat: what other interest in water is less vested than is mosquito control? I don't think there is one.

Mr. Robinson: Thank you, Dick. That was very well done and I knew you could come forward at the last moment, even though you didn't have Frank's speech written out for you–or even a copy of it.

In finishing out this symposium, I believe we should know the various agencies within our districts. Within our County, we have one hundred and thirty-eight taxing agencies, and of course, that includes school districts. I do believe that some of these agencies we are neglecting, and among these are your Cemetery Districts. We all, I think have trouble in cemeteries, with their flower pots and mayonnaise jars, and other things used as water containers there. The cemeteries themselves have their problems in the disposal of some of these things. I know that in the nineteen years that I have been working in mosquito control (I am going to catch up with Harold Gray now that he has retired) we have had a lot of cooperation from our cemeteries in putting in reversible containers. This is a very good selling point because these containers can be reversed and the lawn movers run right over them. Other types of containers are a nuisance to the cemetery people as well as to us.

There are also the Soil Conservation Districts–and while I am on that subject, Marv Kramer asked me if anyone here had any agreements, cooperative or otherwise, with any of the Soil Conservation Districts. If so, I would like to have you raise your hands so Marv can see who you might be. Oh boy, you've got a whole lot of them here, Marv. You were thinking you didn't have any–I think also as Mr. Durbrow mentioned, a little conversation with these different agencies, to discuss their problems and our problems is a very vital thing for all of us to do. Sometimes it saves both districts money by being able to do this. I know through many years of experience with mosquito abatement districts that they are very vitally interested, because they are on a very limited budget. Having talked with several irrigation districts I know they are in the same position as many other agencies of the State and Federal Government are. We are all limited as to funds, and I think that cooperation early in the game–knowing your different agencies in your community–will pay off handsomely to all agencies concerned.

If there is nothing further, I will turn the meeting back to our new President, Gordie.

Pres. Smith: Thanks very much for your fine program, Chet and Mr. Durbrow and Mr. Ogden, and I'll be durned if I ever knew anybody like Dick Peters that could get away with reading the same paper for two different subjects– You want it printed in the Proceedings, too, I imagine?

That finishes the program for this afternoon. I would like to call a short meeting of the Board of Directors immediately after this session, here in front.

FIFTH SESSION

WEDNESDAY, FEBRUARY 4, 1959, 8:30 A.M.

President Smith called the final session to order and introduced Richard F. Peters who had arranged the programming for this session. In that many of the presentations were to be given by personnel working or affiliated with the Bureau of Vector Control, Mr. Peters asked Dr. A. Ralph Barr, Supervisor of Vector Research under the Bureau, to moderate this session of invitational papers.

Dr. Barr: Has Dave Reed come in yet? Since Dave is not here yet, we will skip his paper and come back to him. We will begin the program with a paper by Ernie Meyers of the Bureau of Vector Control, entitled "Mosquito Collections by Light Traps at Various Heights Above the Ground." Ernie.

MOSQUITO COLLECTIONS BY LIGHT TRAPS AT VARIOUS HEIGHTS ABOVE GROUND

ERNEST G. MEYERS

Associate Vector Control Specialist

Bureau of Vector Control

California State Department of Public Health, Bakersfield

Introduction

The vertical distribution of mosquitoes in tropical rain forests has been studied by many workers in South America and in Africa (Davis, 1944; Galindo, *et al.*, 1950; Haddow, 1945; Haddow *et al.*, 1947 to name only a few). Few studies of this kind have been carried out in the temperate zones of the world. In the United States, Glick (1939) collected insects from high altitudes with nets attached to airplanes. Snow (1955) collected biting dipterans as high as 75 feet above the ground. Bellamy and Reeves (1952) found that *Culex tarsalis* Coquillett would enter carbon dioxide baited traps at heights up to at least 25 feet. These findings suggested that further work along this line would be useful. The present study is an attempt to determine at what heights above the ground various kinds of mosquitoes can be collected by light traps.

Materials and Methods

American Model light traps (Mulhern, 1953) equipped with white, 25-watt inside-frosted bulbs were used to collect adult mosquitoes. Pulleys were used so that the traps could be serviced from the ground and then raised so the bulbs of the traps were 5½, 25 and 50 feet above ground when in operation. The traps were operated for 12 hours nightly beginning at 6 or 7 p.m. Previous to this study the traps were tested and found to be equally attractive to mosquitoes.

The first tests were carried out in 1955 at the Meadowbrook Gun Club near Buttonwillow, Kern County, California. The light traps were suspended from a wooden water tank tower located among trees ranging from 15 to approximately 75 feet in height. Nearby were cultivated fields, pasture, unreclaimed desert and a dry stream channel.

The study was expanded in 1956 to include another area, the Rio Bravo School, located about 12 miles east of the Gun Club. The three traps were suspended from a metal water tank that was surrounded by lawn used as an athletic field. There were no trees within 200 yards of the water tank although there was a line of shrubs about 150 feet to the west.

The test for significant differences in all cases was a "t" test utilizing paired variates. Statements of significance are based on a 95 per cent confidence level.

Results

A preliminary study was carried out at the Meadowbrook Gun Club in September, 1955, which suggested that *Aedes nigromaculis* (Ludlow) was most abundant in the two lower traps and *C. tarsalis* most abundant in the two upper traps. The data obtained, however, were not extensive enough for the differences to be significant, since the traps were operated on only four nights.

Accordingly an expanded study was undertaken in 1956. The data for the traps at the Meadowbrook Gun Club are shown in Table 1.

A total of 4544 mosquitoes was collected during the 42 trap nights of operation. Of this total about 68 per cent were *C. tarsalis* and about 26 per cent were *A. nigromaculis.*

The data were tested to determine whether the ratio of males to females of each species was about the same at each level. No significant differences in sex ratio were found so subsequent comparisons were based on the number of individuals of a species regardless of sex.

C. tarsalis was significantly more abundant in the trap at 25 feet than at either the 5.5 or 50 foot trap. The numbers of *A. nigromaculis*, on the other hand, did not differ significantly in the lower two traps, but there were significantly fewer caught in the upper trap than in the middle one. As would be expected from these results, the middle trap caught significantly more mosquitoes of all kinds than did either the upper or lower trap. In terms of numbers this difference was about 2.5 times as great. The total numbers of mosquitoes taken at 5.5 and 50 feet were not significantly different, however.

At the Rio Bravo School a total of only 263 mosquitoes was collected in the three traps for the 42 trap nights of operation. Of the total numbers collected 89 per cent were *A. nigromaculis.* Only 26 specimens of *C. tarsalis* were taken. Fourteen of the 26 specimens were collected at the 5.5 foot level. The numbers of mosquitoes collected were so small that no conclusions could be drawn from them.

TABLE 1

NUMBERS OF MOSQUITOES COLLECTED BY THREE LIGHT TRAPS AT VARIOUS HEIGHTS ABOVE GROUND

Meadowbrook Gun Club, Kern County, California, 1956

Date	5.5′			25′			50′		
	Culex tarsalis	*Aedes nigro-maculis*	*All species*	*Culex tarsalis*	*Aedes nigro-maculis*	*All species*	*Culex tarsalis*	*Aedes nigro-maculis*	*All species*
July 20	0	1	1	118	1	120	18	0	18
26	35	18	53	77	6	83	----	----	----[a]
Aug. 9	----	----	----[a]	124	126	253	193	33	233
16	40	56	96	98	8	115	61	3	67
20	41	10	51	52	0	53	15	0	15
28	17	11	28	88	29	122	15	6	22
29	23	161	186	104	189	295	15	15	30
Sept. 10	41	77	124	164	60	234	63	16	82
20	----	----	----[a]	173	2	176	155	1	163
26	116	141	287	238	113	379	124	47	174
Oct. 3	74	29	122	150	39	217	32	6	51
10	136	8	148	226	6	243	26	0	28
16	27	1	34	62	1	67	20	1	24
24	2	0	7	91	0	137	1	0	6
TOTALS	552	513	1137	1765	580	2494	738	128	913

[a] Trap not in operation.

Source: State of California, Department of Public Health, Bureau of Vector Control records.

Discussion

The results presented above show that *C. tarsalis* was most commonly taken at the Meadowbrook Gun Club in traps 25 feet above the ground. *A. nigromaculis,* on the other hand, seemed to be equally abundant at 5.5 and 25 feet and significantly less so at 50 feet. In this area there was tall vegetation which might provide a favorable environment for mosquitoes at rather high elevations. Therefore, a similar study was carried out at Rio Bravo School which lacked such tall vegetation. Unfortunately, too few mosquitoes were taken for meaningful conclusions in spite of the fact that this locality has been extensively used for encephalitis studies. The low catch of mosquitoes here may have been due to the relatively exposed placement of the traps.

From work done previously (Hammon *et al.,* 1945; Reeves and Hammon, 1944) and other investigations in progress, it is evident that *C. tarsalis* feeds primarily on birds. Feeding takes place during the time when most of the birds have roosted. A large number of bird species roost rather high above ground (10 to 12 feet or higher). It would seem natural that *C. tarsalis* would be more common at higher levels. *A. nigromaculis,* on the other hand, feeds primarily on mammals. There being relatively few, if any, arboreal mammals in the area, it would again seem natural that the species would be most abundant at lower levels. Further tests are needed under different ecological situations to confirm the general validity of these findings.

Summary

American Model light traps were operated at 5.5, 25 and 50 feet above the ground in three studies in two areas. Only one of the three studies was extensive enough to give meaningful results. *C. tarsalis* was more abundant in collections at 25 feet than at 5.5 or 50 feet. *A. nigromaculis* was equally abundant in collections at 5.5 and 25 feet but less so at 50 feet. These findings are interpreted in light of the feeding habits of the species.

Acknowledgments

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Dr. Barr: Thank you, Ernie. In view of the tightness of the program I doubt if we can get many questions in. However, there is a little time left, and if anyone has a question they wish to ask Ernie, I think they can do so at this moment. If not, we will go back to the first paper scheduled for this morning, by David E. Reed, Manager of the Tulare Mosquito Abatement District, Tulare, California, entitled: "Light Trap Captures Without the Benefit of Light."

Mr. Reed: The first that I would like to say is that the purpose wasn't to throw out the use of light traps, but merely to explore some of the unknowns in the use of light traps.

MOSQUITO LIGHT TRAP CAPTURES WITHOUT BENEFIT OF LIGHT

DAVID E. REED
Manager-Entomologist
Tulare Mosquito Abatement District

Introduction

Observations made during 1954 in Kings County showed that large numbers of mosquitoes were captured on two occasions when the light failed to operate in a light trap. It was further noted that these trap collections were virtually free of all other insects. On identification of the mosquitoes captured without benefit of a light, a considerable increase of *Culex quinquefasciatus* was noted. Also there were no *Aedes* species found. (Figure 1)

During the summer of 1958, a study was made in Tulare to determine how consistently captures of mosquitoes occurred in a light trap operating without the benefit of a light throughout a season. A specific purpose of the study was to see if *Culex quinquefasciatus* collections in a light-OFF trap were consistently higher, and also maintained the same seasonal trend as collections from a light-ON trap. Of added interest was to determine if the *Aedes* species, particularly *Aedes nigromaculis*, remained absent in a light-OFF trap throughout the season.

Methods and Techniques

For the purpose of this study, two American model light traps were used. The two traps were tested for air flow capacity and found to be approximately equal.

The light traps were hung at 5½ feet above ground from two separate trees located in the back yard of a Tulare city residence. They were placed approximately 50 feet from each other. There were, in addition, two trees located between the traps, thus preventing any light interference from trap to trap. The house was located approximately 60 feet from both traps.

The traps operated a standard 12 hours beginning at 6:00 p.m., June 1 to November 2, 1958. In order to eliminate the possibility of location having a bearing of the final results, traps were altered in operation every other 2 days solely by connecting or disconnecting the light bulbs.

Daily trap collections were made. Male and female mosquitoes were identified to species and recorded by light trap position and by *light-ON* or *light-OFF* trap.

Results and Discussion

Results from the 1958 study showed that *Culex tarsalis* and *Culex quinquefasciatus* were the most common species in both the light-ON and light-OFF traps. This fact was not true in the observations made during 1954 in Kings County. In Kings County, *Culex* species were more common only on the nights when the light was *off* in the trap. (Figure 1)

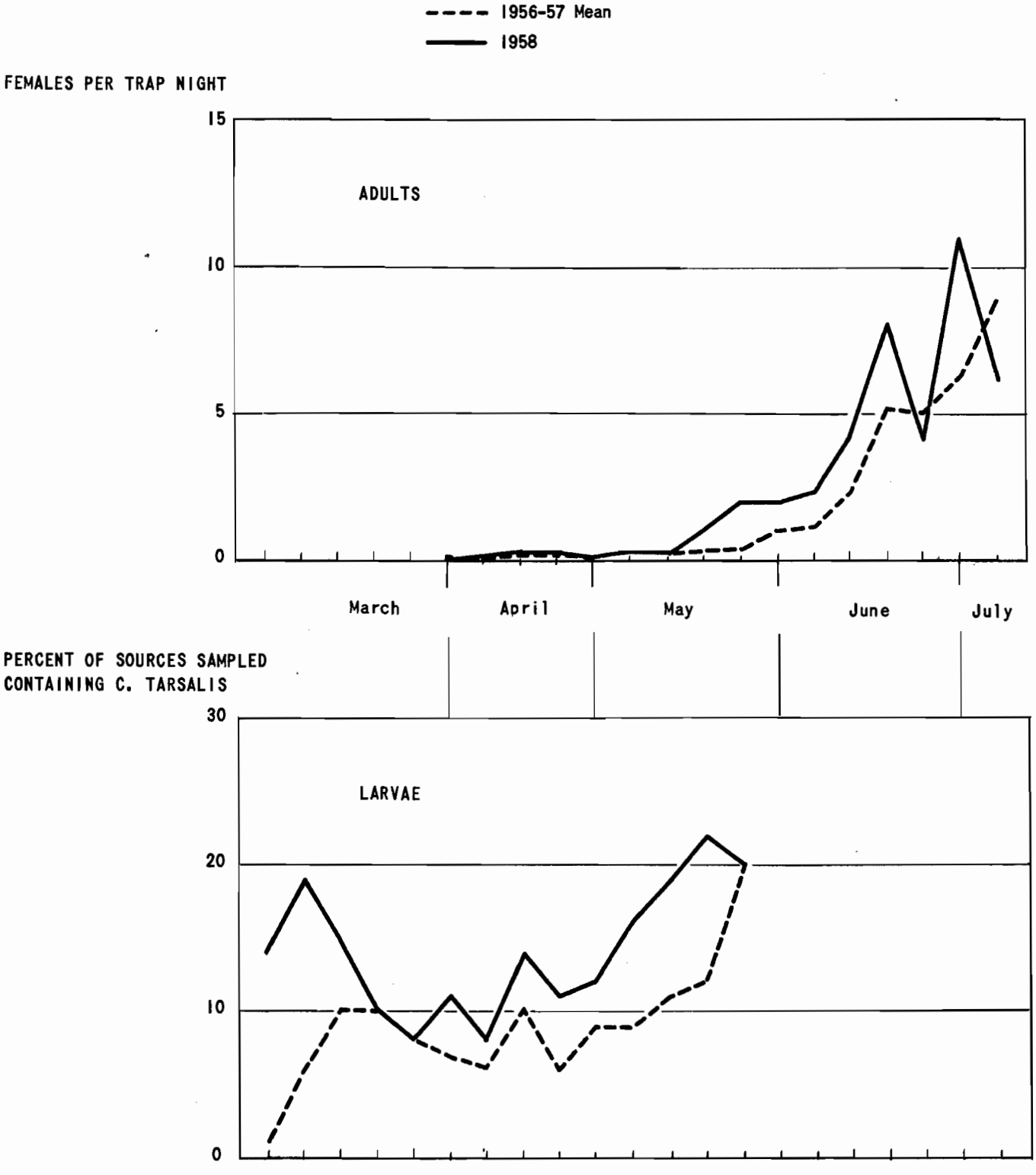
Although *Culex tarsalis* was captured in greater number from the light-OFF trap, the number was not significantly higher than the number collected from the light-ON trap. (Figure 2). The seasonal trend indicated by the light-OFF trap followed a similar pattern to that shown by the light-ON trap. Collections from both light-ON and light-OFF traps showed that the seasonal peak was reached in mid-June and that the population dropped to almost zero early in November.

Numbers of *Culex quinquefasciatus* in the light-OFF trap were consistently twice those in the light-ON trap from June to mid August. From late August through October, numbers in the light-OFF trap rapidly increased to a point where, on the average, trap collections were eight times those from the light-ON trap.

Figure I

POPULATION INDEX OF CULEX TARSALIS

Sacramento Valley, 1956-58

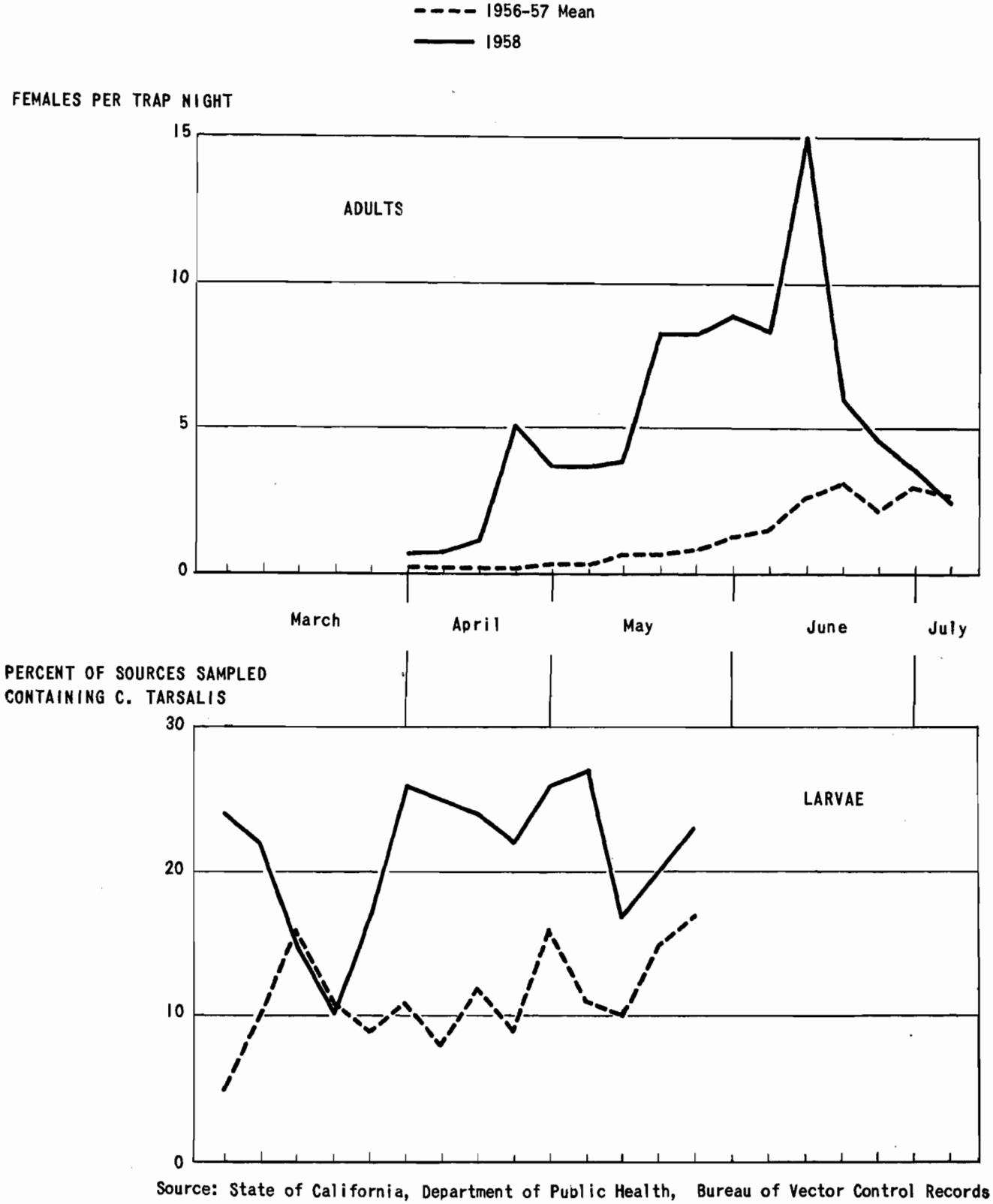


Source: State of California, Department of Public Health, Bureau of Vector Control Records.

Figure 2

POPULATION INDEX OF CULEX TARSALIS

San Joaquin Valley, 1956-1958



Source: State of California, Department of Public Health, Bureau of Vector Control Records

The collection of *Aedes* species amounted to only nine per cent of the total batch of both light traps. The distance of trap location from major *Aedes*-producing sources around the City of Tulare may account for the small number of these mosquitoes captured. There were only four (4) male *Aedes* taken in the light-OFF trap. These 4 specimens may be termed as "an accidental catch" in that they all occurred on nights following the time when a trap operated with the light ON.

Light trap collections were also evaluated for influence by position and found to show no significant overall difference. Although other insects taken in the light trap collections were not identified, it was very obvious that the light-OFF trap collections aways contained far less individuals than those in the light-ON trap. Of special interest was, however, the large number of green lacewings caught in the light-OFF trap.

Conclusions

There is some practical applications in the use of traps operating without a light. For all individuals interested in *Culex* surveys, either for research or control purposes, the light-OFF trap will provide virtually a pure catch of mosquitoes thereby reducing the task in separating collections. More studies should be conducted, particularly in those areas where *Culex pipiens* or *Culex quinquefasciatus* are of greater importance in the control program.

Dr. Barr: I think this a very interesting and important paper. Some of you might have questions which I think we might take a minute to try to answer.

Mr. Grant: Were all of these traps of one type or did you have variations in some of them; that is differences in motor pitch or variation at all?

Mr. Reed: The motors were standard. Everything was the same as for the standardized American traps, including the bulbs.

Dr. Barr: Thank you, Dave. Our next paper is by Edmond C. Loomis of the Bureau of Vector Control in Fresno, and is entitled: "The Importance of Larval Surveys in the *Culex tarsalis* Surveillance Program." Ed.

THE FUNCTION OF LARVAL SURVEYS IN THE CALIFORNIA ENCEPHALITIS SURVEILLANCE PROGRAM

EDMOND C. LOOMIS

Senior Vector Control Specialist
Bureau of Vector Control, California State Department of Public Health

Larval surveys have been conducted on a planned basis by California mosquito control agencies and the State Department of Public Health since 1956. These agencies have also measured adult mosquito populations by a standard system of light trap operation since 1953. The two activities constitute the vector warning system of the encephalitis surveillance program.

The Vector Survey Program

Systematic larval surveys have been included as a part of the encephalitis program during the past three years in an effort to determine the vector (*Culex tarsalis* Coquillett) potential early in the season. The objective has not been to attempt a quantitative measure of larval distribution and density. Even the best larval sampling techniques lack the standardization and reliability necessary to make such an effort meaningful on any large scale. The wide range of natural ecological and man-made conditions found within the boundaries of cooperating control agencies throughout the State further add to the complexity of the problem.

In this program mosquito control agencies have used three methods to determine the occurrence and distribution of larval populations. Field personnel inspect either a large number of water sources at random or a limited number of previously selected sources; some agencies use both methods. The larval sources are classified as natural, agricultural, industrial, or domestic. Sources are inspected by the dipper technique and representative samples of larvae present are identified.

From March through May, 1956 to 1958 approximately 35 control agencies submitted weekly reports to the Bureau of Vector Control. These reports showed the total number of accumulations of water inspected, the number with mosquitoes, and the number with *C. tarsalis*.

Only data from the Central Valley are included in this summary which presents records of larvae and adults of *C. tarsalis* from 14 mosquito agencies in the Sacramento Valley and 12 in the San Joaquin Valley for the years 1956 through 1958. The larval indices are expressed in per cent of all water sources inspected which contain *C. tarsalis*. Weekly light trap collection records are submitted by these agencies and adult indices are expressed as numbers of females per light trap night.

Results

Figures 1 and 2 represent the indices of larvae and adults of *C. tarsalis* in the Sacramento and San Joaquin Valleys, respectively. These records show that larval and adult indices were higher during the early part of 1958 than for the same period in 1956 and 1957. There was, however, a difference between the population trends in the Sacramento and San Joaquin Valleys in 1958. Beginning in March, an early occurrence of larvae was evident in both Valleys. In the Sacramento Valley the larval indices during April and May slightly exceeded those which were recorded during the same periods in 1956 and 1957. As with the larval indices the 1958 adult index was also slightly above the previous two year mean. In the San Joaquin Valley the 1958 larval indices during April and May were far above those for the same months of the previous two years. This was further borne out by far above normal adult occurrence from April through June.

Discussion

The results show a general relationship between the early occurrence of *C. tarsalis* larvae and subsequent

adult populations. Light traps in the San Joaquin Valley have shown detectable adult populations as early as April. In the Sacramento Valley, however, light traps have not shown adult occurrence before May, although larval populations are usually evident in early March. Except for the 1958 data from the San Joaquin Valley, the variations in larval indices have shown little relationship to subsequent adult indices. This has been particularly true during the months of March and April.

It was not anticipated that adult densities in the San Joaquin Valley would suddenly decrease as they did during the end of June, 1958. Since larval surveys had been discontinued this month, the cause of this decline remained obscure.

Adult indices of *C. tarsalis* are not shown for the entire season in Figures 1 and 2. In the Sacramento Valley the 1958 population trend was similar to those observed in previous years (Loomis, 1955) with the greatest density recorded in July and August. The highest density in the San Joaquin Valley normally occurs from the middle of August to the middle of September (Loomis, *op, cit.);* however, in 1958 the peak adult abundance occurred in June.

The abnormally high early season occurrence of *C. tarsalis* in the San Joaquin Valley in 1958 paralleled that recorded during the encephalitis epidemic year, 1952 (Loomis, 1953; Longshore *et al.,* 1955). It was apparent that one of the factors necessary to support an encephalitis epidemic was again present in the San Joaquin Valley. It was evident, however, that conditions were not equally favorable in the Sacramento Valley.

Water reports of the California State Department of Water Resources supported this evaluation. Near record to record breaking rainfall in February, 1958, caused record runoffs in most major watersheds. Heavy rains and snowfall in the Sierras during April contributed to the above normal conditions which approached the record years of 1938 and 1952. Runoff of streams tributary to the Central Valley was estimated at 140 to 200 per cent of average. In the Sacramento Valley the Sacramento River Flood Control Project predicted control of the anticipated runoff. In the San Joaquin Valley, however, it was forecasted that flooding of low-lying agricultural lands would continue into June.

During March and April, 1958, local mosquito control agencies, particularly those in the San Joaquin Valley, were given frequent forecasts of the impending above normal mosquito population. By the end of May, mosquito control agencies in the San Joaquin Valley had increased expenditures substantially beyond normal for the control of *C. tarsalis* at this time of year. Many agencies in this region made applications and received financial aid through the California Civil Defense Disaster Office.

The number of human cases of mosquito-borne encephalitis during 1958 was below the number expected, and far below the 375 cases of western equine and 45 cases of St. Louis encephalitis which occurred in 1952 (Longshore *et al.,* 1955). In 1958 there were 53 laboratory proven cases of which 37 were western equine and 16 St. Louis (California State Department of Public Health, 1959).

Conclusions

Although larval indices are perhaps of limited value for predictive purposes during years of average mosquito abundance, the unusually high early season indices in 1958 provided an indication of above normal adult occurrence which was to follow. It is apparent that more precise methods of measuring larval density are needed in order to establish a direct relationship between early season larval and subsequent adult indices. Other methods of measuring adult populations in the early spring may also be needed in view of the inherent limitations of light traps at that time of the year.

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Dr. Barr: Thank you, Ed. Are there any questions about this paper? If not, I notice that I inadvertently left out one of our San Joaquin Valley speakers, and I had better go back and pick him up before he becomes too unhappy about it. I would like to introduce Dr. W. Donald Murray, Manager of the Delta Mosquito Abatement District. He is going to give a talk entitled: "Measuring Adult Populations of *Aedes nigromaculis.*" Don.

Dr. Murray: Thank you, Ralph. I know you were just trying to catch up. It was about nine o'clock when you called in.

MEASURING ADULT POPULATIONS OF THE PASTURE MOSQUITO, *AEDES NIGROMACULIS* (LUDLOW)

W. D. Murray

Manager, Delta Mosquito Abatement District

Introduction

American light traps[1] are used in mosquito abatement districts in California to collect adult mosquitoes and to provide indices of the abundance of each of the important species. For many years the Delta Mosquito Abatement District has also made measurements of its

[1] Mulhern, T. D., 1953. Better Results With Mosquito Light Traps Through Standardizing Mechanical Performance. *Mosquito News* 13:130-133.

[2] Loomis, E. C., 1958. A Potential *Aedes nigromaculis* Light Trap. Proceedings, 26th Annual Conference, CMCA. pp. 87-88.

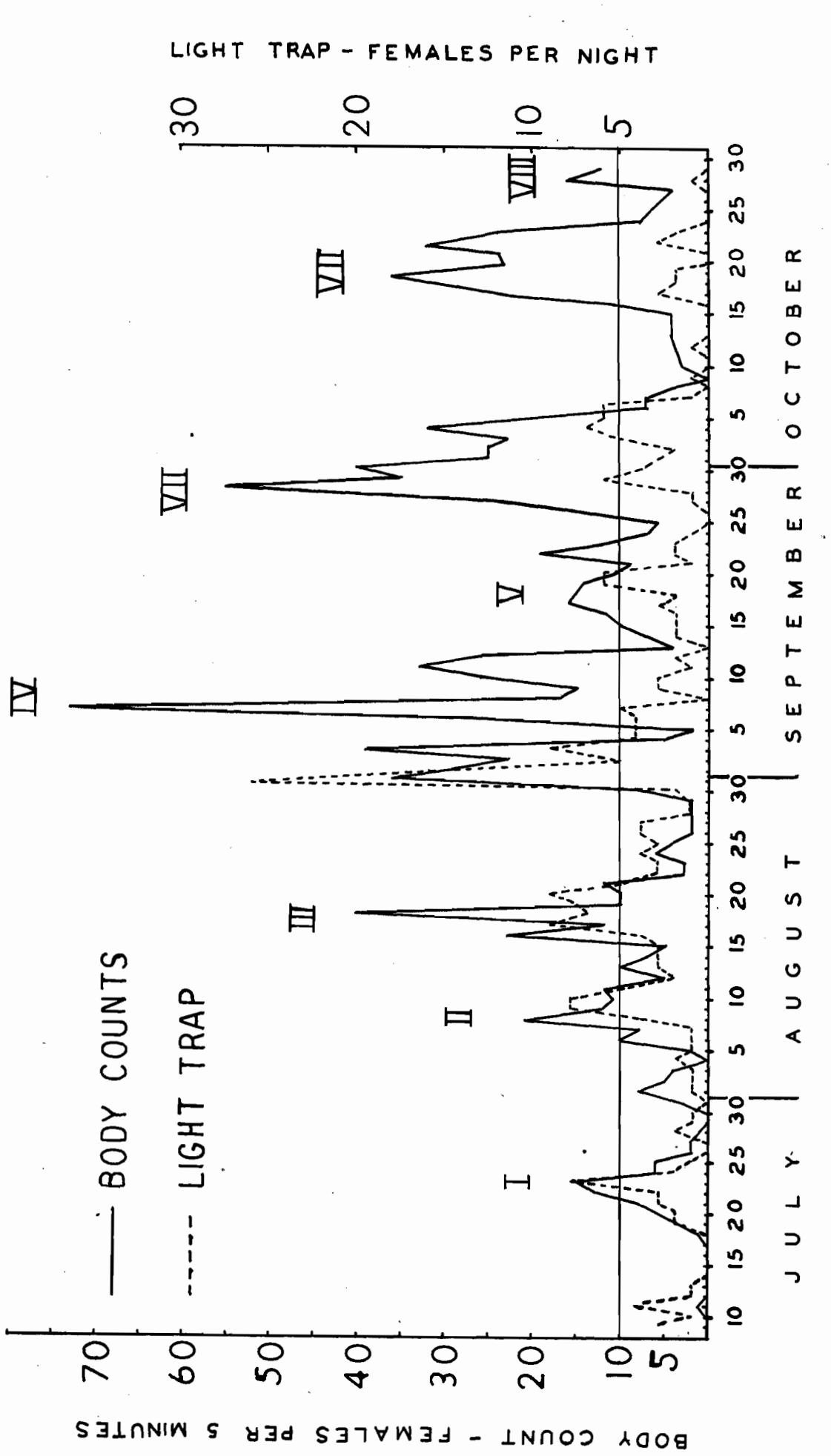

FIGURE 1

BODY COUNTS AND LIGHT TRAP COLLECTIONS OF *AEDES NIGROMACULIS* AT GOSHEN SCHOOL

(TULARE COUNTY, 1958)

most important species, *Aedes nigromaculis*, by body count studies. While both of these measuring devices have usually demonstrated rises and falls of adult populations of this species, there have been some interesting differences between them. The present study was undertaken in order to better evaluate these two methods of sampling the above named mosquito. A modified Minnestota trap[2] was also tested and compared with the American light trap and the body counts.

Methods

The lawn area of the Goshen School, located about six miles west of Visalia, was selected as a suitable site for the measurement studies. This area contains about four acres of green lawn, some part of which is under irrigation almost every day during the summer. The school is located in an area where, during past years, high populations of *A. nigromaculis* have been routine.

Both the American and the Minnesota light traps were supplied with a 25 watt bulb, and were run for 12 hour periods each night, from 6:00 p.m. to 6:00 a.m. One trap setting was south of one of the school buildings, the other north of the same building, so located that the light from one trap could not be seen from the other. The traps were set at a height of 5 feet from the lawn-covered ground, about 15 feet from the building. They were alternated, one north and the other south of the building, then vice versa, approximately every three days, from the time the traps were set up on July 9 until the 2nd of September, after which time no more changes were made. With but a few exceptions, the trap collections were picked up each day.

Body counts were made on the lawn adjacent to the traps. The observer walked slowly and at a uniform speed in a large circle, returning to the point of origin in five minutes. Counts were made of every adult which landed on the body or clothing during this time and, in so far as possible, each adult was killed by slapping so that it would not be recounted. With but a few exceptions the counts were made each day from July 9 to October 29, at approximately 7:00 a.m. throughout this period.

While there were many breeding areas of *A. nigromaculis* in the vicinity of Goshen School and beginning a hundred yards away, these areas were under precision control by the mosquito abatement district and very little, if any, significant emergence of adults occurred within two miles of the school grounds. On the basis of many surveys during the year, it is believed that most of the adults observed had flown from sources at least four or five miles away.

Results

1. Comparison of American light trap with body count.

Figure 1 presents the daily count of mosquitoes through the season as determined by body count and by the American light trap. The Minnesota trap was much less effective than the American trap in collecting female *A. nigromaculis* and is omitted from this graph. Both the body count and the trap show more or less distinct waves of population peaks, however the light trap appears to lose much of its ability to demonstrate these waves late in the season. The waves are labelled in Roman numerals on figure 1, and are specifically determined as those periods when the graph for body counts rises above ten females per five minutes. Inasmuch as these waves are not the result of emergence from local fields, they probably have little if any relation to the specific irrigation of any given field. Probably they are the result of some presently unknown stimulus which caused the adults to take flight from diverse, distant source areas at periodic intervals.

Table 1 presents the actual count of adult females for each month.

TABLE 1

	Body Count	*American Light Trap*	*% of Light Trap Count To Body Count*
July	58	35	60%
August	295	137	46%
September	620	97	15%
October	346	42	12%
TOTALS	1319	311	24%

The totals illustrate that more female *A. nigromaculis* are recorded in five minute periods with body counts than in 12 hour periods with the light trap. For the entire period of study, the body counts accounted for four times as many adults as did the American light trap. The ratio changed during the season, in that later in the season the light traps were much less effective in comparison with the body counts than they were in the middle of the summer.

The question may be raised, "which method gives the better index of the actual adult population in the area?" Several guides, admittedly rather crude, assist in providing an answer to this question.

1) Complaints of citizens.

Table 2 presents the Delta District's total light trap records, body count records, and citizen complaints against *A. nigromaculis* for the past three years.

TABLE 2

	1956	1957	1958
Light trap (females per trap night)	.1488	.1006	.1018
Complaints (actual number)	90	42	22
Body counts (females per minute)	.438	.204	.081

In 1957 the complaints and the body counts were approximately half those in 1956, while the light trap counts were only about one-third less. In 1958 the complaints were about half those in 1957, the body counts were about 40% less, but the light trap counts were essentially the same as in 1957. Thus the complaints appear to be more closely correlated with body counts than with light trap counts.

TABLE 3

	A. nigromaculis		*A. melanomon*		*Culex tarsalis*		*C. quinquefasciatus*		*C. stigmatosoma*	
	male	female	male	female	male	female	male	female	male	female
American	170	307	5	2	17	107	18	272	1	3
Minnesota	92	76	0	0	2	5	0	3	0	0

2) Adult populations in fields throughout district.
Records are kept by the Delta District of adult populations in the various fields throughout the district. These records, kept on individual maps, are technically crude and difficult to summarize, nevertheless they can be correlated more closely with body counts than with light traps, especially late in the season.

3) Larval surveys.
The Delta District records the density of larvae of *A. nigromaculis* in all fields sprayed for every irrigation cycle throughout the season, from March to November. These records are virtually impossible to tabulate, yet they can be studied and compared with other methods of measuring. Under conditions of incomplete larval control, populations of larvae and of subsequent emerging adults increase steadily into or through September, following closely the body count records.

While the light traps may not produce as good an index of the actual populations as the body counts, nevertheless there can be no question but that they do indicate changes in population. If, after sufficient study, the proportion of the light trap count to the body count should prove to be reasonably stable for each period of the year, then a district which had a count from one of these methods could use an appropriate factor and determine what the count from the other method should be.

2. Comparison of American and Minnesota light traps.
The American trap collected about four times more females than the Minnesota trap (311 to 76), and about two times more males (170 to 93). The American trap collected almost twice as many females as males (311 to 170), while the Minnesota trap collected slightly more males than females (93 to 76).

3. Species attractiveness
The records in Table 3 illustrate that the Minnesota trap is highly selective since among mosquitoes it collects almost exclusively *A. nigromaculis*. The American trap collects a general assortment of the common mosquitoes in the area.

4. Effect of location
The south location was far more favorable than the north for males in the American trap (74 to 36), and for females in the Minnesota trap (39 to 11). The south location was about equally favorable with the north for females in the American trap (103 to 90) and for males in the Minnesota trap (39 to 32). This study indicates that the exact location of the trap may play an important part in its effectiveness in collecting *A. nigromaculis*.

Discussion

There are several variables which must be carefully controlled if consistent results with body counts are to be obtained. Among these are:

1. Time of day
Table 4 illustrates the usual pattern of adult activity during the hottest part of the summer in the Delta District.

The records for Table 4 were obtained from a single study on July 29, 1954. While it would be desirable to repeat this study in order to obtain a better evaluation of the hourly change, nevertheless the effect of the time of day is clearly demonstrated. In the experience of the Delta District, early morning is the most suitable time in which to make body counts, and for any given location the counts should be taken within the same hour each day.

2. Exact pathway chosen for survey.
Parts of the five minute survey course invariably produce higher counts than others. The observer should endeavor to select those areas where the highest counts can be expected, however it is important that a consistent routine of survey be maintained. Recently irrigated areas of lawn almost invariably attract more adults than dry lawn areas.

3. Different observer techniques.
Without proper training, different observers may ob-

TABLE 4

Time of day	6 a.m.	9 a.m.	12 noon	3 p.m.	7 p.m.	8:30 p.m.	Next day 8 a.m.
Adults per 5 minutes	660	260	58	37	200	320	270

Sunrise 6:17 a.m.

Sunset 8:07 p.m.

tain widely divergent results. However, observations in the Delta District have indicated that such varying counts are due primarily to different techniques used by the observers and not to personal differences in attractiveness. Body counts have been maintained in this district since 1952. While the writer has made most of these counts, several other trained persons have made numerous routine or special counts and have obtained results which did not appear to differ appreciably from the writer's.

Numerous references in scientific and popular literature have indicated that mosquitoes may be attracted more to one person than another, more to one color than another, or to one odor than to another. However, when a body count is made, following the technique described in this paper, the primary attracting stimulus is motion. If the observer stops while making his count, other stimuli may become dominant, in which case the measurements made by different observers might be quite erratic. The pattern of a slow, steady walk has been quite effective in this district in producing uniform results among different observers.

Summary and Conclusions

Body counts and light traps may be used to provide an index of the relative abundance of *A. nigromaculis*. In the present studies, changing populations of adult females of this species of mosquito were indicated more distinctly by body counts than by light traps, especially in the latter part of the season. The fanless Minnesota trap collected far fewer *A. nigromaculis* than did the American trap, however, it collected this one species almost to the exclusion of the other species of mosquitoes. The location of light traps may be very critical in determining the number of *A. nigromaculis* that will be collected. Mosquito control agencies which have *A. nigromaculis* as an important problem may find that body counts will be more valuable to them than light traps in measuring populations of this species and thus in determining the effectiveness of the control program.

The technical assistance of Edmond C. Loomis of the Bureau of Vector Control of the California State Department of Public Health is gratefully acknowledged.

Dr. Barr: Thank you, Don. I would like to compliment all of our speakers on observing the time limits. Everything has been going along quite nicely so far. I would like to introduce our next speaker, Mr. Ervin H. Kardos of the Bureau of Vector Control who works with the Encephalitis Investigations in Bakersfield. The title of his paper is "Autogeny in Colony *Culex tarsalis*."

THE EFFECT OF LARVAL NUTRITIONAL LEVEL ON DEVELOPMENT OF AUTOGENY IN COLONY *CULEX TARSALIS* COQ.[1]

BY

ERVIN H. KARDOS[2]

Following the discovery that *Culex tarsalis* could produce eggs without a blood meal (Bellamy and Kardos, 1958), various factors which could influence the degree of autogeny in this mosquito have been studied. In the above report, it was observed that rearing of larvae on small amounts of 16 per cent protein food led to reduced autogenous development of ovaries. Obviously autogenous individuals must draw upon food reserves stored during the larval period. The objective of the present study was to determine quantitatively the effect of varying concentrations of larval food on the rate of autogeny.

In studying mosquitoes of the *Culex pipiens* complex (probably *molestus*) Weyer (1934) found that feeding the larvae liver favored autogenous development of ovaries. Shute (1951) reported a low degree of autogeny when *Culex molestus* larvae were reared in exposed distilled water, although on normal diets a high proportion of the females of this species were autogenous. Furthermore, in autogenous females from the distilled water groups the number of eggs produced was less than half the number from "good diet" females.

Materials and methods

Culex tarsalis egg rafts were collected from a single night's deposition of the Bakersfield autogenous subcolony. This subcolony had been maintained for approximately 50 weeks, 17 generations, without blood feeding. For hatching, 123 egg rafts were floated in a pan of tap water. Larvae which hatched in a nine-hour period were pooled, and then distributed 150 larvae each to 19 white enamel pans (11½ x 7 x 2¼ inches dimensions), one additional pan received 300 larvae. Each of the 20 pans were placed in one of 5 groups to receive one of the following amounts of 28 per cent protein mash food.[3] Group I, 0.4 grams; Group II, 1.6 grams (included the one pan of 300 larvae); Group III, 6.4 grams; Group IV, 16.0 grams; Group V, 25.6 grams. Each pan contained approximately one liter of tap water. The food for each pan was divided into four parts which were added to the pans on the following schedule of days: first day or day of larval hatching, 25 per cent; fourth day, 12.5 per cent; sixth day, 37.5 per cent; eighth day, 25 per cent. The food was sprinkled on the water surface and after it became moist was stirred with an applicator stick. Once or twice a day the pellicle which formed on the water surface was removed by dragging strips of paper toweling over the surface. Air temperature around the pans was 80°±3°F. Very little sediment formed on the bottoms of Group I pans. In pans of the other four groups a heavier sediment formed.

In all but Group I almost all surviving larvae transformed to pupae before the pans were discarded. Some Group I larvae were discarded because of slower development.

[1] This investigation was supported in part by a research grant E-31 (C 11) from the National Institute of Allergy and Infectious Diseases of the National Institutes of Health, U.S. Public Health Service to the School of Public Health, University of California, Berkeley: and was a part of a cooperative project with the Encephalitis Section, Communicable Disease Center, U.S. Public Health Service.

[2] Bureau of Vector Control, California State Department of Public Health, P.O. Box 1564, Bakersfield, California.

[3] Ace Hi Upland Game Bird Starter Mash, California Milling Corporation, Los Angeles. Analysis by the Food and Drug Laboratory, California State Department of Public Health as follows: 27.1 per cent crude protein, 4.0 per cent fat, 4.8 per cent crude fiber, 7.9 per cent ash, 8.9 per cent moisture, 45.1 per cent starch, 0.7 per cent reducing sugar, and 1.5 per cent was not indicated in the analysis.

The pupae were removed with a pipette either by single day or two days' accumulations and transferred to jars. Jars for each group were placed in separate one cubic foot, adult, cloth emergence cages. The cages were covered with wet pads and contained a cotton pledget soaked with a 10 per cent aqueous solution of white "Karo" sugar syrup for food. Temperature of the room in which the cages were kept ranged from 73 to 80°F.

Female mosquitoes were chloroformed, dissected, and examined for ovarian development six to ten days after emergence from pupal stage; in some, the number of eggs were counted. Females with mature eggs were classified as autogenous and the other anautogenous.

TABLE 1

The Effect of Varying Amounts of Larval Food on Development of Autogeny in *Culex tarsalis*

Group	Gms. feed per liter of water	Number females examined	Per cent autogeny
I	0.40	38[1]	16
II	1.60	181	93
III	6.40	145	92
IV	16.00	60[1]	87
V	25.60	15[1]	87

[1]Very heavy larval mortality.

Results

Results are summarized in Table 1. The lowest per cent of autogeny was in Group I females whose larvae had the lowest concentration of food. Although the concentrations of larval food in the other four groups varied as much as 16 fold, there was little difference in the per cent of autogeny, 90±3 per cent. Groups IV and V, with the highest food concentration history, had slightly lower per cents of autogeny than Group II and III. Only Group I differed significantly. There was high mortality of larvae in Groups I, IV and V. The rearing of 300 larvae in one Group II pan did not seem to affect the results when comparisons were made with Groups III, IV or V.

TABLE 2

Group	Number females examined	Number of eggs per female Mean	Range
I	6	53	20-85
II	45	84	50-128
III	30	89	52-128
IV	21	86	45-120
V	13	98	55-133

Counts of the number of eggs in small numbers of autogenous females from the five groups are summarized in Table 2. The number of eggs per female was lowest in group I. Groups II, III, and IV were quite similar and Group V had the largest number and average per female. As in Table 1 only Group 1 females differed significantly from the other groups.

Discussion

This experiment would indicate that there may be a threshold of larval nutrition which affects the development of autogeny in *C. tarsalis*. Below this threshold autogeny would be suppressed and there is no significant difference in the expression of autogeny above certain nutritional levels. Determination of critical nutritional levels would provide a basis for comparison of food levels in natural breeding areas. It is likely that when only small amounts of food are available in natural breeding areas, the expression of autogeny in wild females would be restricted.

Females were held for eight to twelve days after pupation and there was low mortality in this interval. At the end of this period ovaries were mature in autogenous individuals. Using Christophers' (1911) classification, all individuals were easily differentiated into one of two groups: with mature eggs, late stage 4 and stage 5; or stage 1 and early stage 2 with slight deposit of yolk. There were no intermediate stages.

Summary

Feeding of various concentrations of high protein mash to *Culex tarsalis* larvae from an autogenous colony, indicated there was a minimal nutritional level required for full development of the autogenous characteristic. There was no appreciable difference in the per cent of autogenous females from larval groups receiving the larger amounts of food.

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Dr. Barr: Thank you, Ervin. Are there any questions concerning this paper? Autogeny is a confusing factor in the encephalitis studies. The more we get to know about it, the better we are going to be able to interpret results in that field. The next paper is by Bettina Rosay, also of the Bureau of Vector Control in Fresno. The title of her paper is: "Growth Changes of Mosquito Eggs." Bettina.

EXPANSION OF EGGS OF *CULEX TARSALIS* COQUILLETT AND *AEDES NIGROMACULIS* (LUDLOW) (DIPTERA: CULICIDAE)[1]

BETTINA ROSAY

Bureau of Vector Control, California Department of Public Health

ABSTRACT. Measurement of eggs of *Culex tarsalis* and *Aedes nigromaculis* showed that they increased in size

[1]This paper has been submitted for publication in the Journal of Insect Physiology.

after they had been laid. The expansion was presumably due to water uptake. Since lengthening occurred in infertile as well as fertile eggs, water uptake was not dependent on embryonic development. Infertile eggs increased more than fertile ones.

Fertile *C. tarsalis* eggs increased in length rapidly at first and continued to lengthen gradually until hatching occurred. Fertile *A. nigromaculis* eggs underwent nearly all of their expansion during the first few hours after oviposition, and after this time no further changes in size were apparent. The termination of their lengthening was correlated with the appearance of a membrane that prevented additional uptake of water. Since water-proofing was due to an embryonic membrane, it was found only in fertile eggs. Therefore, *A. nigromaculis* eggs are permeable to water for only a short time after they have been laid, and the failure of insecticides to kill eggs has probably been because they were applied after the eggs had become impermeable to water.

The patterns of lengthening can be related to the oviposition sites of each species. *C. tarsalis* eggs are laid on a water surface where water is continually available to the developing egg. *A. nigromaculis* eggs are laid on moist soil. Since the habitat is drying, these eggs must take up all needed moisture quickly.

Dr. Barr: Thank you, Bettina. Our next paper is by Richard C. Husbands of the Bureau of Vector Control in Fresno. His paper is entitled: "The Gonotrophic Cycle of *Aedes nigromaculis*." I hope you will explain what the gonotrophic cycle is, Dick.

PRELIMINARY STUDIES OF THE GONOTROPHIC CYCLE OF *AEDES NIGROMACULIS* (LUDLOW) (Diptera: Culicidae)

RICHARD C. HUSBANDS

Senior Vector Control Specialist
Bureau of Vector Control
California State Department of Public Health

The complete cycle of ovarian development from time of feeding to oviposition is known as the gonotrophic cycle (Covell, Russell and Swellengrebel, 1953). Studies of ovarian development and oviposition have been conducted primarily with anophelines because this information is of great importance in evaluating malaria transmission and control. *Anopheles gambiae* Giles, for example, requires only two days for this cycle in a warm environment; where cooler weather is encountered, however, the cycle requires from three to four or more days. Muirhead-Thomson (1951) reported that in Assam *Anopheles vagus* Donitz produced eggs within 24 hours after taking a blood meal. Apparently the length of the cycle is dependent especially upon temperature and the species of mosquito concerned.

Little information is available regarding the gonotrophic cycle in aedine mosquitoes in nature. A mosquito that is especially suited to this type of study is *Aedes nigromaculis* (Ludlow). In agricultural areas in the Western United States this species has many broods in a season and generally produces a single brood in sequence with each irrigation. Emergence occurs over the entire field within a relatively short period of time. Each brood as it emerges is effectively isolated from the previous brood due to the short life span of adults in the field. Since few adults remain in the field at the end of fourteen days, the application of irrigation water at intervals of two weeks or more will produce a series of new populations.

Simultaneity of emergence makes it possible to follow adult development. In the female mosquito this includes the resting period after emergence (a short period during which no feeding takes place) and mating and feeding, as well as ovarian development and oviposition. Daily samples of females taken in relatively isolated irrigated pastures can be used to study the rate of ovarian development. Factors other than time, however, are known to influence ovarian development and oviposition in mosquitoes. It is said that in some mosquitoes there is an interrelationship between fertilization and the utilization of blood meals for egg production. Occasionally more than one blood meal is required before egg production is complete (Muirhead-Thomson, 1951) although most mosquitoes seem to lay eggs following a single blood meal. Usually females are reluctant to oviposit if they are uninseminated; Gillett (1956) has shown recently that strains of *Aedes aegypti* (Linnaeus) may differ in this regard.

MATERIALS AND METHODS:

A preliminary study was initiated in a selected 90-acre irrigated pasture located in Stanislaus County, California (T55, R9E, S9). This pasture was designated as the Schaub study pasture. The study was conducted from June 14 to August 14, 1950. During the period of study no mosquito control was undertaken on this pasture.[1]

A factor which limited the significance of the data obtained from this study was the large size of the pasture and the influx of mosquitoes from adjacent areas. Since the 90 acres could not be irrigated in less than 12 to 18 hours the emergence period lasted from 24 to 36 hours.

A sample of adult mosquitoes was taken daily from the central twenty acres of the field. Adults were collected with a sweep net, killed, and transferred to the laboratory for identification and immediate dissection. Occasionally, other research activities interfered with the routine of daily sampling. However, during this period a total of 1888 specimens was examined from six irrigation cycles.

A similar study was conducted in an irrigated pasture in Madera County, California (T12S, R20E, S16). This field was physically isolated from adjacent pastures and was designated as the Cobb study pasture. The period of study was from July 22 to October 17, 1951. Irrigation of this area generally required 6 to 12 hours. Emergence of adults from this field took place over a very short period of time, usually 8 to 16 hours.

Adult mosquitoes were collected in the same manner as employed in the 1950 study. Experience improved

[1] Through the courtesy of the pasture owner and the Turlock Mosquito Abatement District.

TABLE I

Proportions (in per cent) of females of *Aedes nigromaculis* found inseminated at indicated times after emergence

Days after emergence[1]

Date	0	1	2	3	4	5	6	7	8	9	10
July 23	6.1	30.6	77.2	80.2	89.0	98.0	100.0	83.8	100.0	89.0	100.0
Aug. 11	----	----	68.9	70.7	78.2	91.0	91.0	----	100.0	87.1	89.0
Aug. 23	----	----	73.7	----	84.1	79.0	97.0	89.9	----	----	----
Sept. 1	----	32.7	62.9	81.8	85.0	99.0	100.0	89.0	93.0	92.0	96.0
Sept. 19	----	----	----	70.0	76.0	100.0	89.0	84.0	98.0	88.0	100.0
Oct. 1	----	37.1	79.2	80.8	82.0	92.0	100.0	100.0	84.0	100.0	99.0
	6.1	34.5±7.80[2]	71.4±3.29	76.2±2.90	82.4±2.12	94.1±3.52	96.3±2.21	89.2±2.63	95.0±3.39	91.2±2.12	96.8±2.32

[1] Each sample is comprised of 95 to 103 individuals.
[2] Standard error of the mean.

the handling of specimens and the accuracy of sampling. Sweep net samples of adults were taken daily for about 14 days following the emergence of each brood. Six broods were observed and 1,621 females were dissected. Dissected females were categorized as follows: unfed (adults with no signs of a blood meal and no signs of egg development), gravid and fed (females with partially developed ovaries and generally with some signs of a blood meal), gravid (with mature ovaries irrespective of condition of gut).

The rate of insemination in the *A. nigromaculis* population was determined from samples of approximately 100 females taken daily following each emergence studied. Insemination was determined by the presence of spermatozoa in the spermathecae. Females were collected as described above in the Cobb's pasture study area from July 22 to October 28, 1951. All samples were taken in the center of the field from 2:00 to 4:00 p.m. The females resulted from six irrigations and the day of emergence of each irrigation began when about two thirds of the adults had emerged. Mean temperatures during the period of study ranged from 79°F. in July to 65°F. in mid October. From July through September the average daily mean temperature was 76°F.

Egg production in unmated females was also studied. Females were obtained from field collected pupae following the August 11 and August 23 emergences. Approximately 1500 unmated females were caged in groups of 10 to 25 individuals and held at 80°F. and 80 per cent relative humidity. Twenty per cent of the caged females received suger water only, while the remaining groups received human blood for engorgement was offered daily, beginning at intervals of two, four, and six days following emergence. Clean moist sand was supplied for egg-laying. Samples of mosquitoes were taken from cages at regular intervals to determine ovarian development; eggs were stored on moist sand at 80°F. and were examined weekly for evidences of embryonic development.

Results:

Rate of Insemination. These data, Table 1, indicate that for the six irrigations the bulk of the females had been inseminated two days after emergence and insemination was essentially complete five days after emergence.

Egg Development in Virgin Females. Tests with uninseminated females of *A. nigromaculis* indicated that mating was not essential for egg production since blood-fed virgin females readily produced eggs. In unfed virgin females the development of the ovarian follicles was arrested when they were in approximately stage II of Christophers. When a blood meal was taken the ovaries continued development until mature eggs were formed. Virgin females oviposited in these tests but the eggs failed to embryonate.

Field Studies of the length of the gonotrophic cycle. Studies conducted in 1950 and 1951 on field populations of *A. nigromaculis* are summarized in Tables 2 and 3. The peaks of feeding and egg development are indicated by the boxed percentages. Although the data contain a number of variables, they give a general indication of the length of the gonotrophic cycle under field conditions. The peak of engorged females occurs about three days after emergence. The peak of the gravid fe-

males occurs about four to five days after emergence; from this it can be inferred that the first gonotrophic cycle requires about two days. A second peak of blood seeking females seems to occur on about the fifth or sixth day after emergence. Further events in the life history of adults are not clear from the data, but they suggest a numerically important second gonotrophic cycle and, in the 1951 data, possibly a third. The high average temperature of 76°F. from July through September apparently shortened the cycle.

DISCUSSION:

This is a preliminary study of egg development in *A. nigromaculis* populations. Factors which can influence the gonotrophic cycle and which should be taken into consideration are temperature, light intensity or duration, availability of hosts, and population mortality.

The gonotrophic cycle of approximately two days in *A. nigromaculis* populations, as demonstrated in this study, is similar to the length of the cycle reported in other mosquitoes found in tropical and temperate regions. The cycle allows for the rapid development of *A. nigromaculis* populations in irrigated areas, permitting the successful production of broods of mosquitoes with each period of irrigation. Each cycle of irrigation is a potential source of increasing numbers of mosquitoes during the season and may be influenced by many factors. The length of the gonotrophic cycle is important as related to the length of the irrigation cycle. It has been pointed out that variations in the length of

TABLE 2

A study of the gonotrophic cycle of *Aedes nigromaculis* based upon the dissection of 1888 mosquitoes from six emergence broods from June 14 to August 14, 1950

Days after Emergence	PER CENT OF MOSQUITOES SAMPLED						
	Unfed	Fed	Fed & Gravid*	Gravid	Per cent of Total	Days	
-1	69	0	8	23	1		
E	94	0	4	2	5	E	
+1	94	1	4	1	11	1	
2	92	7	1	0	22	2	1st Feeding
3	52	21	22	5	15	3	
4	43	14	34	9	3	4	
5	41	3	26	30	14	5	1st Oviposition
6	50	12	24	14	15	6	2nd Feeding
7	16	3	20	61	5	7	? 2nd Oviposition
8	52	2	13	33	3	8	
9	64	2	23	11	3	9	
10	47	10	22	21	3	10	
PER CENT OF TOTAL	64	8	15	13	100		

* half gravid

time between irrigations and the oviposition cycles theoretically may influence larval densities (Husbands and Rosay, 1952).

Other interesting biological phenomena may be related to the oviposition cycles. For example, certain areas of fields may be more attractive to gravid females for oviposition sites. If a majority of the *A. nigromaculis* population deposits eggs during the two peaks of oviposition following emergence, a majority of the eggs may be found in preferred sites. If true, this knowledge could aid in the development of ovicidal control techniques. Another interesting aspect of gonotrophic cycle studies is the determination of the age of mosquitoes. The rate and number of cycles of ovarian development will provide a clue to age. This information will aid studies of mosquito population movements.

It is apparent that further refinements in this approach to mosquito ecology are needed. As previously pointed out, the influence of environmental factors should be considered carefully in studies of this type.

TABLE 3

A study of the gonotrophic cycle of *Aedes nigromaculis* based upon the dissection of 1621 females collected during six periods of emergence from July 22 to October 18, 1951

Days after Emergence	PER CENT OF MOSQUITOES SAMPLED					
	Unfed	Fed	Fed & Gravid*	Gravid	Per cent of Total	Days
E	42	25	24	8	4	E
1	84	4	8	5	5	1
2	50	18	20	12	8	2)
						) 1st Feeding
3	38	22	27	14	8	3)
4	19	9	26	45	11	4)
						) 1st Ovi-
5	35	0	17	48	8	5) position
6	35	23	12	30	9	6)
						) 2nd Feeding
7	25	16	45	15	7	7)
8	18	7	49	26	8	8)
						) 2nd Ovi-
9	12	14	35	39	10	9) position
10	4	32	28	35	8	10) 3rd Feeding
11	18	15	38	29	6	11
12	8	11	45	36	5	12)
						) 3rd Ovi-
13	6	67	0	28	1	13) position?
14	36	0	26	38	3	14
PER CENT OF TOTAL	28	15	28	29	100	

*half gravid

The males of the population should be studied, especially with regard to mating behavior. In addition, a realistic appraisal of this information is needed. These studies were conducted essentially with isolated mosquito populations. In California, irrigated fields are seldom isolated; therefore, mosquito populations tend to drift from field to field. This results in populations of mixed ages, and in turn adds to the complexity of interpreting the significance of the gonotrophic cycle.

SUMMARY:

Studies were conducted in 1950 and 1951 in relatively isolated populations of *A. nigromaculis* to determine the gonotrophic cycles. These preliminary studies indicate that two and possibly three cycles of ovarian development occur in a single brood. However, due to population mortality only two cycles are considered significant. Peaks of gravid females occur on the 4th and 5th, and on the 8th, 9th, and 10th days following emergence. It was also indicated that the degree of insemination in the population did not influence the egg production cycle in the field.

Information about the length and the number of cycles will help to determine where eggs will occur in the field. The ability to locate these sites may have a definite bearing on mosquito control methods.

ACKNOWLEDGMENTS:

These studies were aided by the diligent efforts of Messrs. Johnson T. Prescott (now M.D.) and Andrew C. Browne, Bureau of Vector Control, California State Department of Public Health.

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Dr. Barr: Due to the brevity of the last few speakers, we have at last caught up with our schedule. Are there any questions about this interesting paper? Our next paper is by Jay E. Graham, Manager of the South Salt Lake County Mosquito Abatement District, Salt Lake City. His paper is entitled: "The Current Status of *Aedes nigromaculis* in Utah."

THE CURRENT STATUS OF *AEDES NIGROMACULIS* (LUDLOW) IN UTAH

J. E. GRAHAM
South Salt Lake County Mosquito Abatement District

Aedes nigromaculis (Ludlow) was wide spread in Utah when the first mosquito surveys were made by Rees in 1929 and 1930. The records compiled at this time indicate that this species was not as numerous as some other species in the state but it was locally abundant in Cache County and Salt Lake County and was found, and may have been locally abundant, in other counties.

After several years of control work by the Salt Lake City Mosquito Abatement District, *A. nigromaculis* seemed to have disappeared in the city and surrounding area (Rees 1954). Unfortunately quantitative data regarding populations of this species in other parts during the period when it was disappearing in and around Salt Lake City are lacking.

In 1953 the Salt Lake City Mosquito Abatement District and the South Salt Lake County Mosquito Abatement District each found a large brood of *A. nigromaculis* emerging. The brood found by the Salt Lake City district was in an area that had been inspected regularly for many years but had not been known to produce this species. Rees (1954) reported this reappearance of the species in Salt Lake County and asked the following question: "Is this a remnant of a species disappearing from the area under mosquito abatement pressures or is it a recent revival of this species which may develop into a major control problem such as exists in parts of California where this species has recently made an appearance?"

In 1958 Graham and Rees reported that the species was apparently increasing in numbers and distribution in Salt Lake County. Intensive larval surveys conducted by the South Salt Lake County Mosquito Abatement District show that larvae of *A. nigromaculis* have increased in number and extended their range in the district each year. In 1958 they were found in 23 areas compared with 18 in 1957 and 12 in 1956. In 1958 the Salt Lake City Mosquito Abatement District collected 65 specimens of *A. nigromaculis* in light traps, 23 of these in one night. This is more than have been taken in light traps in all of the previous years combined. However, all of the specimens were taken in one trap that had been operated in its present location since 1952.

Although there has been a definite increase in numbers of this species in Salt Lake County during the past few years, the situation in Utah is different than in California.

A. nigromaculis was first taken in California in 1937 (Aitken 1939) and by 1940 its spread had been impressive (Aitken 1940). By 1951 it occurred over most of the state at lower elevations (Freeborn and Bohart 1951). In a period of 14 years the species had appeared in California and developed into a major control problem. In Utah the species was well established and, in some areas abundant when the first surveys were made in 1929 and 1930. Although an increase in numbers of *A. nigromaculis* has occurred in Salt Lake County in recent years, it is not a major control problem and may be no more numerous now than it was 30 years ago.

The factors that caused the fluctuation in numbers of this species in Salt Lake County, and perhaps the rest of Utah, have not been determined. Rees (1954) suggested that control operations may have been responsible for the decline in numbers in and around Salt Lake City, but the increase since 1954 has occurred during a period when control has been more effective than in the past. This does not eliminate control pres-

sures as a factor in the decline of the population but the influence of other undetermined factors must have been greater.

The distribution of *A. nigromaculis* in South Salt Lake County in 1956 and 1957 did not conform to apparent available habitat but seemed to indicate that control operations may have been responsible for the increase in number and distribution (Graham and Rees, 1958). Such a result would occur from control operations if *A. nigromaculis* were held in check under natural conditions by a competitor that was reduced or eliminated by control procedures. *A. dorsalis*, a possible competitor, is the most abundant mosquito in the larval habitats utilized by *A. nigromaculis* and is more susceptible to control procedures. Edmunds (1953) noted that larvae of *Aedes dorsalis* were not as resistant to spraying operations as *A. nigromaculis*. Inspection and spraying schedules in Salt Lake County are adjusted to the life cycle of *Aedes dorsalis* but the time required from flooding of eggs to the emergence of the adult mosquito is 1 to 2 days less for *A. nigromaculis* than for *A. dorsalis*. In some cases this allows adults of *A. nigromaculis* to emerge before the pool is sprayed.

There is no evidence to indicate that competition between the two species adversely affects populations of either one in Salt Lake County and the presence of significant populations of *A. nigromaculis* in Cache and Utah counties where *A. dorsalis* is abundant and there are no control programs shows that when conditions are suitable this species will be abundant regardless of any competition that might exist. Beadle (1955) reports that 4% of the mosquitoes collected biting at a rural site west of Logan in Cache County were *A. nigromaculis*. Myklebust (1959) found that approximately 4% of the adult mosquitoes taken in light traps and biting in a mosquito survey in Utah County were *A. nigromaculis*. Populations of *A. nigromaculis* in Salt Lake County are not this large. There is no evidence to indicate that predators have had a significant effect on populations of *A. dorsalis* or *A. nigromaculis* in Utah.

Summary and Conclusions:

Aedes nigromaculis was found in many parts of Utah, sometimes abundantly, when the first mosquito surveys were made in 1929 and 1930. The species apparently declined in number in and around Salt Lake City, perhaps partially as a result of control activity of the Salt Lake City Mosquito Abatement District. In recent years it has become increasingly abundant in Salt Lake County and is locally abundant in other counties in Utah. Control operations have generally kept populations of this species below nuisance level in Salt Lake County but were probably of little consequence either in the decline in numbers in the late 1930's or the increase which occurred from 1953 to the present. Changes in populations of *Aedes nigromaculis* in Utah in the past 30 years have been noticeable but minor. In the future populations of this species will probably fluctuate but no major change in the relative importance of the species is indicated.

Acknowledgments:

I wish to express my appreciation to Dr. Don M. Rees of the University of Utah for providing me with information regarding mosquito collections in past years and for his valuable suggestions in preparing this paper. I also wish to thank Dr. Lewis T. Nielsen and Dr. George F. Edmunds, Jr. for their helpful comments and suggestions.

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Dr. Barr: Thank you, Jay. Before we go out for a short recess, I think Gordon Smith has a few words that he would like to say to you. After this recess, the next paper is supposed to start at 10:10, so let's get back in from this recess promptly and end promptly at the end of the morning.

Pres. Smith: Before we go on this morning, I think there is one thing we should remark on and express delight with, and that is the large number in the audience from the Boards of Trustees who have taken advantage of the meetings to come here and meet the Association. Could we have all the Board members stand? Let's give them a big hand. I think it is most welcome for the Board members to come and take advantage of the meeting, and get the most out of some of the long words in most of these papers. There will be a recess then until 10:10.

(RECESS)

Dr. Barr: The next paper on the program is by Dr. Mir S. Mulla, Harold D. Axelrod and Dr. Robert Metcalf of the University of California at Riverside, and their paper has been given a slightly different title from that in the program.

GRANULAR FORMULATIONS OF INSECTICIDES AND FACTORS INFLUENCING THEIR EFFICIENCY IN MOSQUITO CONTROL[1]

MIR S. MULLA AND HAROLD AXELROD
University of California Citrus Experiment Station, Riverside

Introduction

Granular formulations of insecticides have been used in programs for control of pest mosquitoes in California (Washburn 1956, Lewallen and Brydon 1958). The formulations employed in routine or experimental control programs have been obtained from various commercial sources. Since the ingredients of a particular type of formulation other than the insecticide usually vary from one formulation to another, results obtained from the use of these materials are not expected to be consistent.

Very little is known regarding the basic factors governing the efficiency and performance of granular formulations of insecticides. This study was undertaken for the purpose of elucidating the role of some of these factors in relation to the effectiveness of granules against mosquito larvae. It was hoped that the outcome of such a study might lead to more efficient and economical formulations that could be widely employed in programs for the abatement of mosquitoes and other insect pests.

First, it is attempted here to give a clear picture as to what the granular formulations are and then briefly enumerate some of the advantages that these formulations have over others. Finally, a brief summary of the current research findings will be presented.

What Are Insecticidal Granules?—The main ingredients of a granular formulation are (1) an insecticide, (2) an inert granular carrier, and (3) a solvent for impregnating toxicants on the inert materials. In certain special types of formualtions the third step might be eliminated.

In addition to these ingredients, other materials such as coating agents, wetting substances, and other additives may also be incorporated to make the formulation dust-free and free-flowing.

In almost all cases each of the constituents of a granular formulation seems to be a complex material, with unique chemical and physical properties. When two or more of these materials are formulated they form a complex chemical system. The ultimate efficiency of these formulations as pest control agents will undoubtedly depend on the properties of their constituents and many other factors, such as temperature, air movement, type of soil, pH of water, etc., under which these formulations are being used.

Advantages—The use of granular formulations for treating breeding grounds of mosquitoes has several advantages over that of emulsifiable concentrates. Some of these advantages are listed below:

(1) Granular formulations are easily applied to inaccessible niches, either manually or by broadcast and blower-type power equipment.

(2) These formulations can be utilized in situations where dense plant cover such as aquatic vegetation or food and forage crop canopy would not permit spray treatments. Under such circumstances, the granulated material would penetrate the plant cover to the breeding source of mosquitoes while most of the spray volume will be intercepted by the plant cover.

(3) The toxicity hazards of granulated insecticides to applicators are considered to be lower than those of spray treatments. Application hazards due to splashing and spilling of emulsifiable concentrates are not a problem when suitable granular materials are used.

(4) The residue level of toxicants on food and forage crops due to larviciding for mosquito control is likely to be lower for granular materials than for spray applications.

(5) With selection of proper ingredients of a granular material, a steady release of the toxicant might be obtained for a relatively longer period of time. This is especially desirable for those insecticides which are soluble in water. Greater solubility in water might lead to rapid breakdown (hydrolysis) or disappearance of the toxicant due to dilution of treated bodies of water with additional water.

(6) Shipment and handling of solid formulations (granules) may be economical and time-saving as compared to emulsifiable concentrates. Carrying and hauling large quantities of water for preparing dilute sprays for field use might result in a high cost of mosquito control per unit area. A great deal of time and effort could be saved by using a suitable granular material instead.

Factors Influencing Release of Toxicants From Granular Materials

Investigations on this phase of the problem are at present in the beginning stage. Research work accomplished thus far points out the complexity of the problem. It has been determined that the rate and extent of release are influenced not only by the various ingredients of the formulation but also by the conditions under which it is used.

In order to determine the rate and extent of release, the problem was pursued under controlled laboratory conditions. The tests were made on 4th-instar larvae of *Culex quinquefasciatus* Say. All tests were made in tap water having pH values of 8-8.5. The granular formulations were prepared in a small unit where speed of the tumbler and the volume of air for impregnation were controlled. Separate batches of formulations prepared in this way yielded uniform results (table 1). At the beginning of the test the variation for the individual samples seems to be large, but as time progresses this variation becomes smaller.

Vertical Stratification of Toxicants—When a granular formulation is added to a column of water, the particles of denser granules settle at the bottom. Subsequent release of the toxicant throughout the column will probably depend on the solubility of the toxicant and characteristics of the solvent, carrier, and other additives.

Both commercial and laboratory formulations were subjected to tests for determining the distribution of the toxicant in a column of water. In some of these formualtions the distribution of the toxicant in water columns (6.25 inches high) was found to be stratified. The toxicant was confined mostly to the bottom layer.

[1] Studies supported by a grant from Fresno, Kern, and Westside Mosquito Abatement Districts.

TABLE 1

RATE OF RELEASE OF TWO PER CENT PARATHION FROM SIMILAR FORMULATIONS ON ATTAPULGITE GRANULES (30/60 RVM-AA) IN WATER.[a]

	Average Percent Release at:					
	8 hours		24 hours		48 hours	
Formulation	*Top*[b]	*Bottom*[b]	*Top*[b]	*Bottom*[b]	*Top*[b]	*Bottom*[b]
			Experiment A			
A	28	25	28	19	16	18
B	22	23	18	18	19	19
C	22	43	18	17	19	19
D	48	31	16	17	15	16
			Experiment B			
A	31	30	22	22	18	18
B	26	28	23	24	17	18
C	37	29	25	21	18	19
D	27	26	20	24	16	16

[a] Velsicol AR-60 at 20 per cent of the total weight of the formulation was used as solvent. The gradual decrease in the release of parathion as time progresses is a characteristic of this solvent.

[b] Top and bottom of 6¼-inch column of water. Individual samples were withdrawn from these regions for further dilution. Five replicates in each treatment.

TABLE 2

DISTRIBUTION OF MALATHION AND PARATHION RELEASED FROM VARIOUS COMMERCIAL GRANULES IN WATER (6.25-INCH COLUMN) AS TESTED AGAINST MOSQUITO LARVAE

Insecticide & Percent Conc.	*Carrier*		4 hours		24 hours		48 hours	
		Layer[a]	*% Mortality*	*% Release*	*% Mortality*	*% Release*	*% Mortality*	*% Release*
				Experiment A				
Malathion 10	Attapulgite	T	2	5	97	32	100	34+
	RVM-A 15/30	M	2	5	98	34	100	34+
		B	33	10	97	32	100	34+
Malathion 5	Bentonite	T	0	0	15	8	82	20
	8/20	M	2	5	23	9.4	80	19.6
		B	33	10	28	10	86	22
Malathion 7½	Bentonite	T	7	7	18	8.8	60	15
	8/20	M	0	0	22	9.3	53	14
		B	45	12	33	10	60	15
				Experiment B				
Parathion 2	Soluble	T	3	6	21	10		
	granules	M	17	9	32	11		
	8/16	B	100	40+	100	40+		

[a] Top, middle and bottom of 6.25-inch column of water.

TABLE 3

DISTRIBUTION OF PARATHION RELEASED FROM ONE PER CENT FORMULATION ON SOLUBLE GRANULES IN A 6.25-INCH COLUMN OF WATER[a]

	Percent Mortality and Release after:					
	8 hours		24 hours		48 hours	
Layers	*Mortality*	*Release*	*Mortality*	*Release*	*Mortality*	*Release*
Top	32	70	1	34	15.5	52
Middle	22.5	60	1.5	34	1.5	34
Bottom	90	100[b]	90	100[b]	83	100[b]

[a] Formulation obtained from a commercial source.

[b] Per cent release calculated on the assumption that the toxicant is distributed uniformly throughout the column. It is for this reason that the calculated per cent release for the bottom layer is 100 per cent or over.

Portions of water aspirated from the middle and top layers indicated lower amounts of toxicant in these layers than in the bottom layer (tables 2, 3 and 4).

Based on the above information it is apparent that vertical distribution of toxicants in deep bodies of water will have a profound bearing on the degree of control obtained for various species of mosquitoes occupying specific ecological niches in the aquatic habitat. Formulations that yield toxicants in the bottom portion would be more desirable for controlling bottom-inhabiting mosquitoes. For controlling top-feeding larvae, formulations that release insecticide at top and middle portions would be more suitable.

Granular Carriers—The types and various meshes of the same class of material influence toxicant release from inert particles. Indirect comparison of 15/30 and 30/60 meshes of attapulgite has indicated that granules of the latter size are more efficient than those of the former size. Similarly, various kinds of granular materials released the toxicant at varying rates and magnitudes. For example, a 1 per cent parathion formulation on attapulgite (LVM-AA) granules gave approximately 40 per cent release of the toxicant after 48 hours, while a 1 per cent parathion formulation on RVM-AA type released 18-25 per cent of the toxicant. Similarly, a varying per cent release has been observed with the use of bentonite, vermiculite, and organic granules.

Solvents and Solvent Concentration—The effect of solvent on the rate and pattern of release of toxicants in water is rather striking. Investigations in this respect have been carried on only when impregnating malathion or parathion on attapulgite (RVM-AA) granules. Therefore, the statements reported here refer to such formulations only.

A low initial release of parathion (2 per cent concentration) on attapulgite RVM-AA granules was obtained when this material was impregnated with some of the Velsicol solvents (AR-60, 55, and 50). The quantity of available insecticide in water further decreased from the initial level, with respect to time, thus obviating the possibility of readsorption. On the other hand, the release of similar formulations but with solvents such as Velsicol AR-35, Espesol 1, 2 and 5 released low quantities of the toxicant initially, but this level increased markedly with elapse of time. For example, the per cent release from 2 per cent parathion at 48 hours' interval was approximately 60 per cent for Velsicol AR-35, Espesol 1, 2 and 5. A similar formulation made with AR-50, 55, and 60 released 22 per cent, 14 per cent, and 8 per cent of the toxicant, respectively, after an exposure of 48 hours. Other solvents such as acetone, xylene, and kerosene were found to perform poorly when compared indirectly.

The problem of the effect of the solvent concentration on per cent release has not been studied thoroughly. Preliminary results, however, indicate that this factor for certain solvents has an important role in the efficiency of granular formulation.

Temperature—The temperature of water to which a granular formulation is added has a profound effect on the rate and extent of release of a toxicant. The release of parathion and malathion granules at various temperatures has been extensively studied in the laboratory. The results of these studies shed light on the important role that temperature plays in influencing the rate and magnitude of release of toxicants.

Initial release (at 8 hours) from malathion granules (5 per cent on attapulgite 30/60 LVM-AA) was directly proportional to the temperature of the water. The per cent release increased rapidly with lapse of time at temperatures of 90°, 70°, and 50° F., until the peak was reached, after 48 hours. The release at 35° F. increased gradually but reached the peak after 72 hours. After reaching the peak (at 24 hours) the formulation at 90° F. started to show decrease in the amount of active toxicant in the water. This trend continued up to 72 hours at which time no mortality of larvae was obtained at a level of dilution that yielded an approximate mortality of 100 per cent at 8 hours' and 24 hours' exposure time. This quantitative drop in malathion level in water is not due to the nature of the granules but to the intrinsic properties of the compound. A more rapid rate

TABLE 4

DISTRIBUTION OF PARATHION RELEASED FROM GRANULAR FORMULATIONS (PREPARED IN THE LABORATORY) IN WATER AS DETERMINED BY TESTING AGAINST MOSQUITO LARVAE

Parathion Conc. Percent	*Carrier & Preparation Method*	*Solvent & Percent of Total Wt.*	*Layer*[a]	*Percent Mortality of Mosquito Larvae and Percent Release*					
				8 hours		*24 hours*		*48 hours*	
				Mort.	*Rel.*	*Mort.*	*Rel.*	*Mort.*	*Rel.*
2	AA-RVM 16/30 Impregnation	AR-60 20	Top	38	18.5	20	14.5	9	11
			Bottom	80	32.5	36	18	13	12.5
1	Alfalfa Granules 15/30 Soaking	Xylene 33	Top	13	8.6	2	5.3	2	5.3
			Bottom	32	12.5	85	24	58	16

[a] Top, middle and bottom of 6.25-inch column of water.

Other formulations, on the contrary, released the toxicant in such a way that the distribution throughout the water column was relatively uniform (table 5).

TABLE 5

DISTRIBUTION OF PARATHION RELEASED IN WATER FROM A TWO PER CENT GRANULAR FORMULATION (ON ATTAPULGITE 16/30 RVM-AA GRANULES)[a]

Layer	Average Percent Mortality and Percent Release at:					
	8 hours		24 hours		48 hours	
	Mortality	*Release*	*Mortality*	*Release*	*Mortality*	*Release*
Top	2	8	31	17	27	16
Bottom	0	0	26	15.5	27	16

[a] Formulation prepared in the laboratory with xylene (20 per cent of the total weight) as a solvent.

of decomposition has been observed for malathion emulsifiable concentrate at a temperature of 70° F., or higher (Mulla *et al.* 1958).

Parathion granules (2 per cent on 30/60 RVM-AA attapulgite), on the other hand, followed a different pattern of release at various temperatures. The initial release (at 8 hours) was negligible at 35°, 50°, and 70° F. and relatively low at 90° F. However, at 24 hours' testing the release at both 70° F. and 90° F. was equal and reached a peak which was maintained up to the 72 hours' testing time. At 35° and 50° F., the release was still very low.

Insecticides—As described previously, insecticides themselves behave differently when other factors are controlled precisely. The various trends indicated by malathion and parathion attest to this fact. (See preceding section on "Temperature.")

Preliminary results from similar formulations of malathion, parathion, and dieldrin also affirm the role of a particular insecticide as related to its release from granular particles. In these studies, indirect comparisons showed that malathion and parathion formulations released more than 55 per cent of the active material within 24 hours. When a similar formulation of dieldrin was prepared and tested, the level of release up to 48 hours was negligible. Based on their solubility characteristics, this trend is rather to be expected.

References Cited

Lewallen, L. L., and H. W. Brydon, 1958. Field tests with organophosphate granular insecticides against mosquito larvae in Lake County, California. Mosquito News 18(1): 21-22.

Mulla, M. S., H. Axelrod, and R. L. Metcalf, 1958. Studies on the efficiency and performance of insecticidal formulations against mosquito larvae with special emphasis on granular insecticides. (Unpublished report.)

Washburn, G. E., 1956. Granular pesticides in California mosquito control. Mosquito News 16(2): 104-5.

Dr. Barr: The next paper is by Lawrence L. Lewallen, of the Bureau of Vector Control in Fresno and is entitled: "Toxicological Studies on Mosquito Larvae, 1958."

LARVICIDING TESTS AGAINST MOSQUITOES IN CALIFORNIA

LAWRENCE L. LEWALLEN[1]
Senior Vector Control Specialist
California State Department of Public Health
Bureau of Vector Control
Fresno, California

Field testing of mosquito larvicides was expanded in 1958 to include not only *Culex tarsalis* and *Aedes nigromaculis* but other species as well. Toxicity data were also obtained on *Culiseta inornata, Anopheles freeborni* and *Aedes melanimon.* The tests were performed in the manner previously described (Lewallen 1958).

New organophosphates tested included Dibrom, Hercules 3895G, Phostex, and Ethion, as well as Kepone, a chlorinated hydrocarbon. Previously tested organophosphates on which additional information was obtained included Korlan, Guthion, Trithion, Dylox, Co-ral, and Delnav.

The results of 1958 field tests are summarized in Table I.

TABLE I

Twenty-four hour per cent mortality to fourth instar larvae

Dosage lb/acre	*Culiseta inornata*	*Culex tarsalis*	*Anopheles freeborni*	*Aedes melanimon*	*Aedes nigromaculis*
Korlan 24 per cent emulsifiable concentrate					
0.4	95	86	100	----	----
0.5	----	----	----	91	----
0.75	----	96	----	96	98
1.0	----	----	----	----	100
Dibrom 8 lb/gal. emulsion concentrate					
0.2	46	----	32	----	----
0.3	64	50	----	----	----
0.5	----	71	84	88	73
0.75	----	91	----	----	99
1.0	----	----	----	----	100
Guthion 1½ lb/gal. emulsion concentrate					
0.25	100	96	----	100	96
0.3	----	----	----	----	99
Trithion 4 lb/gal. emulsion concentrate					
0.2	57	----	----	----	----
0.3	85	96	----	----	80
0.4	----	----	----	99	98
Trithion 4 lb/gal. flowable					
0.2	23	91	----	96	90
0.5	----	----	----	----	98
0.75	----	----	----	----	100
Dylox 50 per cent soluble powder					
0.5	78	93	----	99	86
0.75	----	----	----	----	95
1.0	----	----	----	----	99
Co-ral 1 lb/gal. emulsion concentrate					
0.2	----	----	----	99	86
0.25	100	----	----	----	96
Delnav 4 lb/gal. emulsion concentrate					
0.5	50	80	----	79	86
0.75	82	100	----	----	93
Hercules 3895G 25 per cent emulsion concentrate					
0.2	99	87	40	89	91
0.5	----	100	100	----	----
Phostex 8 lb/gal. emulsion concentrate					
0.4	90	----	----	----	----
0.5	----	37	----	----	----
0.75	----	----	----	----	56
1.0	----	----	----	30	----
Ethion 25 per cent emulsion concentrate					
0.1	----	----	----	----	51
0.2	81	72	----	----	----
Kepone 2 lb/gal. emulsion concentrate					
0.2	----	----	----	32	----
0.5	----	----	----	----	45
1.0	----	----	----	----	76

Guthion, Co-ral, and Hercules 3895G gave the best performance from the standpoint of toxicity to mosquito larvae. It is interesting to note that at 0.2 lb/acre Hercules 3895G did not produce as high a mortality of *A. freeborni* as it did with the other species. Also, Korlan at 0.4 lb/acre was required for complete control of *A. nigromaculis.* This emphasizes the importance of basing insecticide performance and recommendations on tests with more than one or two species of mosquitoes. Other instances of specificity are evident from the data presented.

Higher dosages of Korlan and Trithion were required for complete mortality than had been indicated by earlier work on mosquito larvae. Since many of these tests were performed on parathion-resistant *A. nigromaculis* larvae in Kings County, a degree of cross resistance to these compounds may be indicated.

References

Lewallen, L. L. 1958. Larviciding tests against mosquitoes in irrigated pastures of the San Joaquin Valley, California. Proceedings and Papers of the 26th Annual Conference of the California Mosquito Control Association, pp. 89-90.

Dr. Barr: Thank you, Larry. Are there any questions about this work. If this resistance has already occurred in two places in the San Joaquin Valley, as it seems to have done, then there is a good chance that we are

[1] The assistance of Loren M. Nicholson and James H. Bray in carrying out these tests is gratefully acknowledged.

going to see more of it in the coming year. The next paper is by Gaines W. Eddy, who, as most of you know, is with the U.S. Department of Agriculture at Corvallis, Oregon. He is going to give a talk on "Highlights of the U.S.D.A.'s Research on Mosquitoes in 1958." Gaines.

Mr. Eddy: I would like to say that I certainly always look forward to attending the CMCA meetings and I am certainly enjoying this one. We had lovely weather coming down, it's beautiful here, and I hope we have it as nice going back, but all three of us that came down have our fingers crossed.

HIGHLIGHTS ON U.S.D.A.'S RESEARCH ON MOSQUITOES IN 1958

GAINES W. EDDY
Entomology Research Division, Agr. Res. Serv., U.S.D.A.

Research in the U.S. Department of Agriculture on mosquitoes during 1958 was conducted, in general, along the same lines as in previous years. However, more emphasis was placed on basic or fundamental research, and certain new fields of endeavor were undertaken. The major projects and some of the main studies in each will be discussed here.

REPELLENTS

Research on repellents is directed toward the discovery, development, and utilization of effective and economic materials for protecting man and animals from mosquitoes and other blood-sucking pests.

Repellents for Personal Use—Usually several hundred compounds are screened each year as mosquito repellents at the Orlando, Fla., laboratory. However, during 1958 considerably more emphasis was placed on basic research along the following lines: (1) the effectiveness of various formulations, (2) the cosmetic acceptibility of special preparations, (3) basis for the attractiveness of different human hosts, and (4) the fate of repellents applied to the skin of research subjects. Special studies were conducted on the fate of C^{14}-labeled diethyltoluamide applied to guinea pigs. It was found that the repellent absorbed by the different animals ranged from 20% to 47% of the applied dose, and that more than 80% of the absorbed dose was excreted in the urine as water-soluble metabolites in 24 hours. Very little radioactivity was found in the feces, blood, skin, and hair.

Clothing Treatments—About 750 compounds were evaluated as clothing treatments at the Orlando laboratory. Although several materials showed considerable promise in initial tests, they did not prove outstanding when subjected to water rinsing.

In connection with the research on clothing treatments a technique was developed for making observations on the "space repellency" of materials. Two cloth bands are treated with the candidate material, allowed to dry, and then fastened around the arm 2 inches apart. Initial repellency is based on the number of mosquitoes (*Aedes aegypti* L.) biting in the exposed area between the two strips. If no feedings are recorded, the bands are moved farther apart until biting does occur. The objective of this research is to find a material that when applied to clothing will prevent biting on exposed untreated skin of the wearer.

Livestock Repellents—In research on repellents for protection of livestock, materials are usually screened by treating a small area on an animal (usually cattle) and exposing it to hungry mosquitoes at specified intervals thereafter. Several treatments may be run on a single animal by this spot technique. Promising materials are then tried as spray treatments. Aside from repellent data, information is also obtained on the toxicity to adult mosquitoes that engorge. Approximately 150 compounds were evaluated at the Corvallis, Oreg., laboratory. Tests were also run on numerous repellent mixtures and toxicant-type sprays or formulations.

LARVICIDES

Laboratory Screening Program—The procedure for the evaluation of materials as mosquito larvicides utilizes distilled water, early fourth-instar larvae, glass containers, and acetone suspensions of the materials. During 1958 about 1000 compounds were tested against *Anopheles quadimaculatus* Say at the Orlando laboratory. About 60 of them caused 50-100% kill at 1 p.p.m., and several of them were sufficiently toxic at lower concentrations to warrant field tests. In tests with these materials against *Culex tarsalis* Coq. at the Corvallis laboratory similar results were obtained. Those that showed most promise were either organic-phosphorus compounds or esters of chrysanthemumic acid, the former being the most toxic.

Semi-field Tests—One of the most interesting activities undertaken by the Corvallis laboratory was the construction of a number of 400-square foot plots near Fresno, Calif., for toxicological and biological investigations. This project, which is under the direction of the California State Health Department's Bureau of Vector Control, and in cooperation with the Consolidated Mosquito Abatement District of California, will be completed in 1959. According to A. R. Barr, Supervisor of Vector Control Research, these plots will make possible, for the first time, field testing of insecticides under closely comparable conditions where important variables such as number, age and species of larvae, and volume of water can be effectively controlled.

Field Tests—Several tests were conducted by members of the Orlando laboratory with granular insecticides against salt-marsh mosquitoes. Parathion granules with attapulgite as the carrier appeared to be about the most effective, giving complete control at rates as low as 0.05 pound per acre. However, in similar tests against mosquitoes breeding in log ponds in Oregon, parathion failed to give initial kill at 0.25 pound per acre (surface area). Heptachlor gave about the best kill, and its residual effect was better than that of other materials tested at 1 pound per acre.

ADULTICIDES

Contact Sprays—The recent colonization of *Aedes taeniorhynchus* (Wied.) at the Orlando laboratory has made possible the evaluation of materials against this important species. Upwards of a hundred selected compounds were tested as contact sprays against adults in a wind-tunnel apparatus. The materials were dissolved in a refined oil such as Deobase and drawn through the tunnel containing small screen cages in which the mosquitoes were confined. Few of the com-

pounds compared favorably with malathion, which was used as the standard.

Aerosols—Experiments on the development of equipment and use of aerosols for the control of adult mosquitoes were conducted in cooperation with the Brevard County Mosquito Control District of Florida. The first tests were against caged *taeniorhynchus* with malathion applied from a thermal aerosol exhaust venturi mounted on a Stearman airplane. High kills were obtained with 1 pound per gallon in 100-foot swaths, but extension of swath intervals to 200 feet resulted in low mortalities. In similar tests in which malathion was applied from twin exhaust generators, a kill of 86% of caged adults and 80% reduction of the natural population were obtained in 6 hours.

In another aerosol experiment against *tarsalis* conducted at Farmington, Calif., by the Corvallis laboratory in cooperation with the San Joaquin Mosquito Abatement District of California, malathion was applied with a Tifa machine, carbon dioxide being released simultaneously. The results were not encouraging.

Residues—Research by the Orlando laboratory during 1958 confirmed previous findings that the phosphorus compounds as a group are highly effective against adult mosquitoes. Certain chrysanthemumic acid esters were also found effective as residual treatments but only at higher rates of application. In residual spray tests conducted in Arkansas, the insecticides were applied to *quadrimaculatus*-infested buildings that either housed or were near various kinds of domestic animals. Observations were made for 5 weeks on most of the treatments and for 10-11 weeks on some of them. Of seven insecticides tested at 200 mg./sq.ft., malathion, Diazinon, and DDT were the most effective. There was little difference between Diazinon and DDT, but neither was quite as effective as malathion. At twice the rate of application barthrin gave fairly comparable results.

In experiments in Florida against salt-marsh mosquitoes, in which the materials were applied in sprays at 1 pound per acre to infested citrus groves, barthrin and another chrysanthemumate compared favorably with malathion. All three treatments gave good reduction of adults for 48 hours, as determined by landing rates on humans, but little after 6 or 7 days. Heavy rains appeared to have affected the residual life of the treatments.

Studies on Resistance

Studies at Orlando indicated that resistance of *taeniorhynchus* to the chlorinated hydrocarbon insecticides, especially DDT, has become widespread in Florida. Although the laboratory colony has only about a tenfold resistance to DDT, there are areas in the State where resistance is much higher. For instance, in comparative tests with larvae from an untreated area in Georgia, the Florida larvae were at least 40 times as resistant to DDT, 5 times to dieldrin, and approximately 3 times to BHC. Little difference was indicated for malathion or parathion. In further tests based on calculated LC-90's, the larvae from Florida were 8 to 10 times more resistant to DDT, BHC, and dieldrin. Similar resistance to DDT was indicated in adults, but adults from Florida were 2.4 times more susceptible to malathion.

The malathion-resistant *tarsalis* colony maintained at the Corvallis laboratory has about 5-fold resistance to DDT, and 2-fold, as compared with 100-fold, to malathion and several esters of chrysanthemumic acid. In view of the high resistance to malathion, similar resistance might be expected with a number of other phosphorus compounds. No great evidence of this was indicated in tests with 16 compounds, including parathion, Dipterex, dicapthon, ronnel (Dow ET-57), and EPN. A low level of resistance was, however, indicated in the case of Co-Ral.

Toxicological Investigations

Physical Factors Affecting Toxicity of Larvicides—Always of interest to researchers are factors that may influence the results of their investigations. Of particular importance therefore are the data obtained at Orlando on the effect of heat, aeration, pH, and the presence of soil on the toxicity of various insecticides to larvae of *Anopheles quadrimaculatus*. Twenty-four hour exposures to temperatures ranging from 110° to 130° F. decreased the toxicity of water treated with parathion, malathion, Dipterex, and Diazinon. Aeration of the treated water affected only Diazinon. The pH appeared to have only a slight effect, but numerous insecticides lost toxicity in the presence of soil.

Fate of DDT in Aqueous Acetone Suspensions—It has been known or suspected for some time that the larvicidal effectiveness of DDT in the laboratory is influenced by such factors as container size, water volume, and number of larvae used per container. In tests at Orlando with the aid of C-14 and P-32 labeled materials it was shown that many of the factors that affect larval mortality are closely correlated with the species of mosquito and/or the insecticide involved. The chlorinated hydrocarbons, especially DDT, were more easily influenced by changes than were the phosphorous compounds.

The type of container affects the larval mortality caused by certain insecticides. In studies at Corvallis greater kill was obtained in glass than in paper containers. This was true of DDT against floodwater *Aedes* and of DDT and certain other chlorinated insecticides against *tarsalis*.

Research at Orlando on the fate of DDT in aqueous acetone suspensions has gone far in explaining some of these variations. At room temperature considerable DDT was lost from test containers through volatilization. Settling appeared to be an important factor when the concentration of DDT was as high as 1 p.p.m. but apparently not at 0.01 p.p.m. It was found that much of the DDT adhered to the inner surface of the container, even within 2 minutes after mixing. During this period the "affinity" for the sides of the container appeared to be greater for aluminum than for paper or glass. However, after 24 hours approximately 35% of the insecticide was in suspension in the glass containers, 11% in aluminum, but only 2% in the paper containers.

Effects of Irradiation on *Anopheles quadrimaculatus*

In experiments at Orlando with *quadrimaculatus* adults from pupae that had been given a 11,820-roentgen exposure from a cobalt-60 source, irradiated females mated to normal males laid no eggs, whereas normal females mated to irradiated males laid a normal number of eggs but none hatched. When irradiated

males were introduced into a population of normal males and females at ratios of not less than 6:1:1, the reduction of viable eggs was approximately 80%. In tests with adults about 94,000 r was required to cause 50% mortality and upwards of 140,000 r to cause complete kill.

TAXONOMIC AND BIOLOGICAL STUDIES

An accomplishment certainly worthy of mentioning here concerns the completion of a U.S.D.A. Handbook on "The Mosquitoes of Alaska," which includes taxonomy, life history and habits, distribution, prevalence, and control.

AGRICULTURAL PRACTICES IN RELATION TO MOSQUITO PRODUCTION

Although the importance of agricultural practices in relation to mosquito production has been recognized for a long time, our knowledge of the situation is rather limited. A project to obtain such information, with particular attention to irrigation, was set up at Reno, Nevada, in June 1958. This is a cooperative activity between the U.S.D.A. Entomology, Soil and Water Conservation Research Divisions, and the University of Nevada. Correlated with this work will be activities aimed at increasing our knowledge of the taxonomy, biology, and ecology of various species of mosquitoes in the State.

Dr. Barr: Thank you, Gaines, for this very interesting paper. Our next speaker I am sure all of you know. He is Dr. William M. Hoskins of the University of California in Berkeley, and he is going to speak to us about "The Resistance Picture in Agriculture and Public Health." Dr. Hoskins.

Dr. Hoskins: It has been just illustrated by the last couple of speakers that the word "resistance" is in extremely common use in modern entomological literature and discussion. This situation has come to be prominent in the last few years since the wonder insecticides promised to end all of our insect problems.

INSECTICIDE RESISTANCE IN AGRICULTURE AND PUBLIC HEALTH

W. M. HOSKINS
Department of Entomology and Parasitology,
University of California
Berkeley, California

The word "resistance" is probably the most used technical term in modern entomological literature. This situation has come about within the last few years since the wonder chemicals promised to end our insect problems. It is an irony of nature that when victory seemed in sight, it was snatched away, or at least is in serious danger. Resistance to an insecticide is not a new phenomenon for breakdowns of control have occurred with hydrogen cyanide on scale insects, lead arensate on codling moth larvae, tartar emetic on citrus thrips and phenothiazine on screwworms, as well as other less well marked cases. However, it is the resistance to DDT and to BHC by the housefly and by numerous insects of agricultural and medical importance and to parathion by various species of mites that has aroused worldwide interest.

These cases are so definite that a change in control procedures is imperative. But often there is only an indication that resistance is occurring and the practicing entomologist is faced with such questions as: should I prepare for a change of control or will the situation be solved by increasing the dosage, adding a synergist, changing the formulation or some other simple variation of the method in use? Other questions are, if a chemical is stopped before resistance is high, will it be useful again soon, or should a given material be exploited to the full without hope of reuse?

Such situations have focused attention on the problem of recognizing resistance early. It is characteristic of most control programs as well as of laboratory selection under insecticide pressure, that change in susceptibility comes on slowly over eight to ten generations or more and then mounts very rapidly in a few additional generations before reaching a plateau. If a careful determination is made of the relation of dosage to mortality, a steep line is usually obtained with susceptible insect strains which have not been under control with a particular chemical, the plot being logarithm of dosage versus mortality expressed in probits. When a small change in dosage causes a large change in response the population is spoken of as relatively homogeneous in its response. Under insecticide pressure the first effect is elimination of the weaker members of the population so that they do not reproduce their kind. Consequently the log dosage-mortality (or ld-p) line may move slightly toward higher dosages without change of slope or even may become a little steeper.

The effects of further pressure depend upon whether or not there are individuals present so constituted that they can survive greatly increased dosages. If not, the final condition is merely a slight increase in average susceptibility but not real resistance. Since this sort of change can be brought about by any adverse condition and is not specific for a chemical, it has been called vigor tolerance with reference to the fact that it results from a weeding out of weaker members and survival of those of greater general vigor. At most vigor tolerance raises the LD 50 only a few fold.

Suppose, on the other hand, that the original population contained individuals of considerable ability to withstand the chemical. If these are fairly numerous, say five per cent, they will soon make a serious contribution to the whole population as selection continues and the ld-p line will become flatter, which means that the population has become more heterogeneous in response to the chemical. This change in slope is usually the first dependable sign that specific resistance to the selecting chemical is developing. If these resistant individuals are very scarce, e.g., one in a million, they will never be detected unless severe selection is continued for a long period. This was the case with red scale and hydrogen cyanide, for control up to 99+ per cent was secured over large areas for years before resistance was detected. There is always the possibility that it will occur under the right conditions of selection with a chemical so far not thought to cause resistance. Recently, Keiding in Sweden has found 10-14 fold resistance in houseflies after intensive use of a pyrethrin-piperonyl butoxide mixture. Another case is the anopheline mosquitoes which for several years showed no

resistance to DDT but now have been found resistant in numerous parts of the world where DDT has been used intensively.

If selection continues long and intensively enough, the heterogeneous population resulting from increase in proportion of resistant individuals will again turn toward greater homogeneity because of total elimination of weaker individuals. This again can be illustrated by the cases of red scale with cyanide and houseflies with pyrethrin-piperonyl butoxide. In the first case the resulting strain was several hundred fold resistant but in the second case only 10 to 14 fold. Once the condition of high homogeneity is reached further increase in resistance can take place only if a new factor such as a favorable mutation occurs. Furthermore, the more homogeneous the resistant population, the less likely it is to revert to a condition of susceptibility. The numerous contradictory results obtained by different workers who left selected strains without pressure for a period can be explained in terms of differences in homogeneity reached by their populations during the course of selection. All these matters illustrate the important point that resistance is a relative matter and may vary widely in its intensity. Unfortunately, even a few fold increase usually is enough to render a particular chemical useless for practical control.

The literature contains many accounts of laboratory selection from which conclusions have been drawn regarding the ability of the species tested to develop resistance to the chemical used. This is an extremely dangerous procedure, for unless abnormally large populations are taken in the beginning there is a large probability that the relatively scarce resistant individuals will be omitted. Thus it may be predicted that laboratory selection from the original susceptible red scale infestations of southern California would never have revealed the capacity for resistance that field control brought out so strikingly. The only honest conclusion that one can draw from laboratory populations is that one's findings apply to that strain. Of course, if repeated samples lead to the same result, the indication becomes very strong that whatever is found in the samples is very widespread in the general wild population. Thus the ease with which DDT resistance can be developed in almost any sample of houseflies shows that the factor responsible is widespread.

The well-known variations obtained in field control make this an impractical method for detecting the beginning of resistance and following it in any quantitative sense. Accordingly, a number of small scale procedures for use in the laboratory or in the field have been developed. For use with adult mosquitoes, three techniques have been used rather widely. The Busvine-Nash method developed at the London School of Tropical Medicine and Hygiene makes use of a narrow tube within which a sheet of treated paper is inserted and the mosquitoes are left therein for a stated period. The Expert Committee on Insecticides of the World Health Organization modified this, chiefly by using a wider tube, and in this form the method is in wide use in many parts of the world. Results obtained with a somewhat similar device suggested by workers in the U.S. Public Health laboratories at Savannah, Georgia, were considered in the development of the final WHO test kit. To date this has been used with DDT and dieldrin. There is also a WHO larval test kit for mosquitoes. Under study now is a modification of the adult mosquito kit for use with Phlebotomus sandflies, a procedure for testing organic phosphates against adult mosquitoes, a method for use with houseflies and Drosophila and methods for bedbugs and fleas.

One might wonder why there is so much emphasis upon *standard* procedures in oppostion to the natural tendency of investigators to devise methods suited to their particular needs. This has prevailed with houseflies and the tangle of discordant data are an eloquent reason for standardization of methods. There is an equally urgent need for expressing results in the same terms. Thus one experimenter may give LS 50's only which affords no indication of the heterogeneity of the population employed and hence gives no basis for predicting what will happen under selection. Another may wish to emphasize the importance of the resistant portion of the population and gives only LD 90's and another merely states how many fold resistant his strain was in comparison with some standard strain.

It is inherent in the nature of the ld-p line that comparisons made at one level, e.g., the ratio of LD 50's, will be the same at other levels only if the lines are parallel. Since populations differing in degree of heterogeneity toward an insecticide have lines of different slope, comparison must be made at some standard level. This is usually the LD 50 and thus the comparison is expressed in terms of what may be called the average susceptibilities. But since a higher level is more expressive of the resistant portion of the population, some workers also include the LD 90's or 95's. A more general procedure is to give the LD 50 and the slope of the ld-p line from which the LD can be calculated at any chosen level, so long as this lies on the straight portion of the line.

Careful studies at high mortalities have revealed that in most populations there are individuals whose dosage-mortality points do not lie on the line defined by the majority of individuals. It is these nonconforming individuals who can give rise to strains of high resistance. Hence for prediction of future development under insecticide pressure study of this portion of the population is most meaningful. Since they always make up a small fraction of the total number, very large groups must be used. This is seldom practical with mosquitoes taken in the field often under great difficulties. It is, however, practicable to keep count of the percentage surviving the highest dosage used in determining the ld-p line. If an appreciable fraction survive in a number of runs, this is a sure indication that the potentiality for resistance is there even if it has not revealed itself practically. Since contact of insect with insecticide is variable under the most carefully standardized conditions and this will be reflected in mortality, the further suggestion has been made that these insects tolerating high dosages be examined to determine if they have really absorbed large amounts. This can best be done with radioactive insecticides, e.g., C^{14}-DDT or Cl^{36}-dieldrin. Since these materials are rare and very expensive, the standard WHO kit is not useable. In the toxicology laboratory at Berkeley we have been working on a micro exposure chamber in which mosquitoes can be exposed to very small amounts of these chemicals. Preliminary results are promising and we hope to take the devise to the field for tests with mosquitoes caught in the wild this coming sum-

mer. Procedures are already in regular use for extracting the absorbed DDT and DDE formed from it and similarly the absorbed dieldrin and its metabolites. It seems to be a reasonable hypothesis that the ratio of insecticide metabolized to the total absorbed is a more dependable measure of resistance than mortalities determined under the difficulties that attend such work in many primitive regions.

Dr. Barr: Thank you very much for this fine presentation, Dr. Hoskins. I noticed that as Dr. Hoskins was talking, there was a little bit of shuffling in the audience so I think it would be a good idea if everybody would stand up for just a minute and stretch—but don't leave your seats.

Our next paper is entitled: "Factors Contributing to the Encephalitis Epidemic in Utah During 1958," by Dr. Don W. Rees and Glenn C. Collett, and the paper will be given by Mr. Collett.

Mr. Collett: Time is going quickly and I believe we can summarize this paper with a few slides which we have to show. Dr. Rees is the senior author of this paper and asked me to present it, which I am happy to do.

FACTORS INFLUENCING THE ENCEPHALITIS OUTBREAK IN UTAH IN 1958

DON M. REES[1] AND GLEN C. COLLETT[2]

The number of cases of virus encephalitis reported in Utah during the latter part of the summer of 1958 was sufficient to recognize an outbreak or a mild epidemic of this mosquito borne disease. The first cases diagnosed as virus encephalitis were reported the latter part of July. Other cases were reported in August and September and were distributed in counties as follows:

TABLE 1

WESTERN EQUINE ENCEPHALITIS TABULATION FOR CALENDAR YEAR JANUARY 1 TO DECEMBER 24, 1958

OFFICE UTAH STATE DEPARTMENT OF HEALTH

Number of Suspected Cases	
Salt Lake County	78
Weber County	31
Davis County	29
Box Elder County	27
Cache County	7
TOTAL	172
Number of Reported Cases	27
Laboratory Confirmed (Derived from paired sera)	39
Number of Deaths Not Confirmed	13
Number of Deaths Confirmed	1

3 Autopsies One Positive-W.E.E.

[1] University of Utah.

[2] Salt Lake City Mosquito Abatement District, Salt Lake City, Utah.

Note in Table 1 that the virus was identified as the western equine strain and that the majority of the cases appeared in counties located along the Wasatch front and in numbers in each county roughly proportional to the total population of the county.

This outbreak of encephalitis in 1958 was accompanied by a tremendous increase in the *Culex tarsalis* mosquito population in these counties. This was determined by making a comparison of larval and light trap collection records obtained in 1958 with similar collections obtained during previous seasons. A similar increase was reported in the numbers of *C. tarsalis* accompanying the encephalitis outbreak in California in 1952 (Loomis 1953).

In Graph I a comparison is made of the number of locations containing *Culex tarsalis* larvae in 1958 with those containing larvae of this species in 1956 and 1957. Graph I was prepared by J. E. Graham from larval collection data obtained in the South Salt Lake County Mosquito Abatement District.

It is evident from a comparison of data obtained in 1956, 1957 and 1958 there was a significant and successive build up each year in the number of pools containing *C. tarsalis* larvae. The increase in the number of pools in 1958 over the previous two years started in April and more than doubled in May and June, then continued during the remainder of the season considerably above the number in the other two years.

Other common species in the area such as *Aedes dorsalis, Culiseta inornata* and *Culex pipiens* did not show a significant increase in 1958 in the number of pools containing larvae of these species. This is evident from the larval collection data for *A. dorsalis* presented in Graph II. Similar records are available on the other two species.

Similar results were obtained in the light trap collection records of adults obtained in the Salt Lake City Mosquito Abatement District. The data presented is from six New Jersey type light traps that have been operated two nights a week in the same locations for several years, in Salt Lake City. Graph III shows the total number of *C. tarsalis* mosquitoes trapped in six traps by months. Eighty-six per cent of all the mosquitoes captured in eight light traps in 1958 were *C. tarsalis*. In 1957 it was fifty-four per cent and in 1956 thirty-nine per cent *C. tarsalis*.

Graph III depicts the tremendous increase in the *C. tarsalis* mosquito population in Salt Lake City in 1958 by a comparison with collections made during the previous two years. The significant increase began in July, 1958, and attained a peak in August, rather than in September when the peak occurred in 1956 and 1957. The *C. tarsalis* increase in August, 1958, according to these data, was some 500% over 1957 and 700% over 1956. This explosive outbreak which first appeared in the *C. tarsalis* population in July, reached a peak in August and then slowly declined in September, parallels the outbreak expressed in the number of cases of encephalitis reported in Utah during these months.

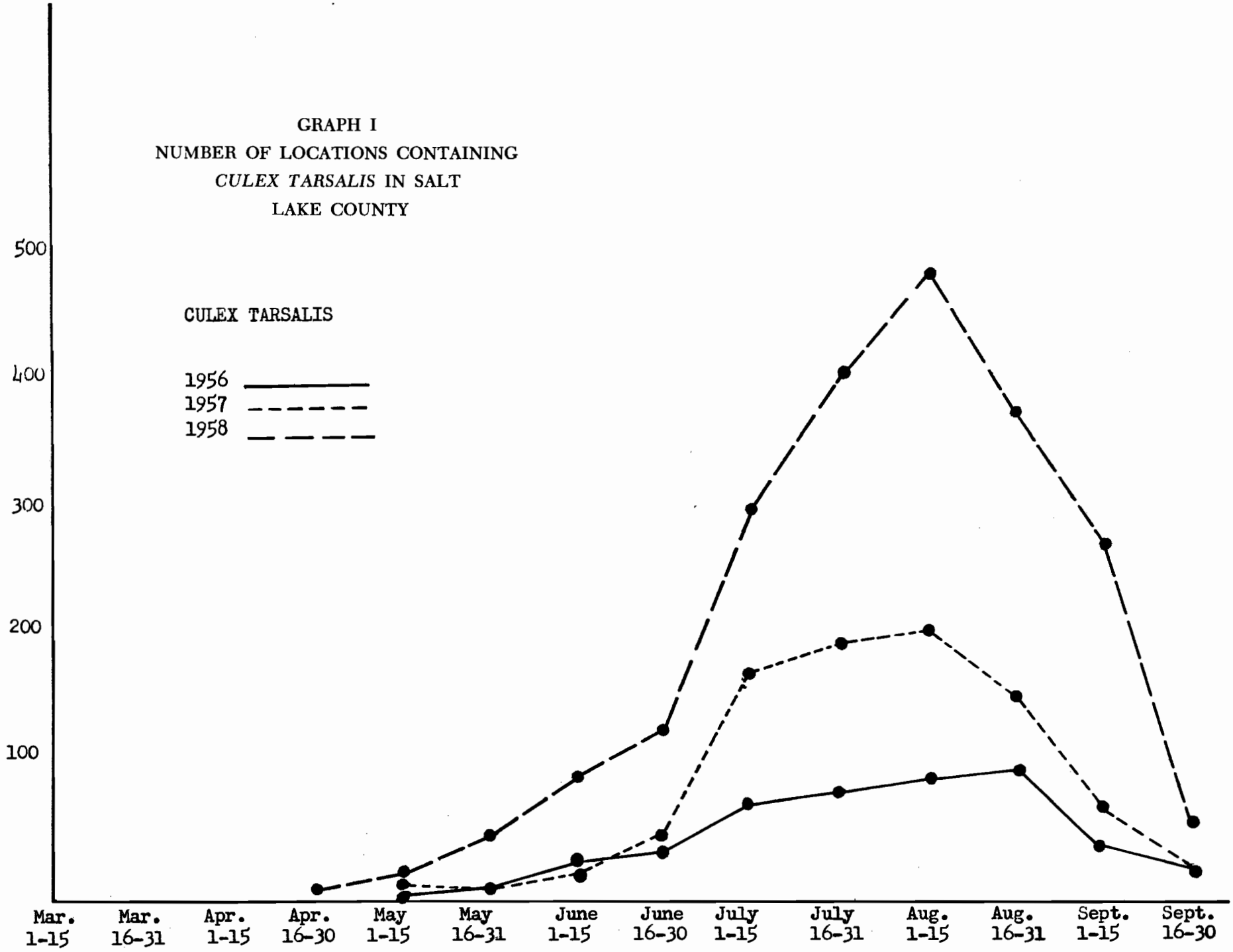
In Graph IV comparative light trap collection data are presented for *A. dorsalis*. It is evident there was no significant increase in 1958 in the number of adults of this species in Salt Lake City. Similar data were obtained for *Culiseta inornata* and for the *Culex pipiens* group.

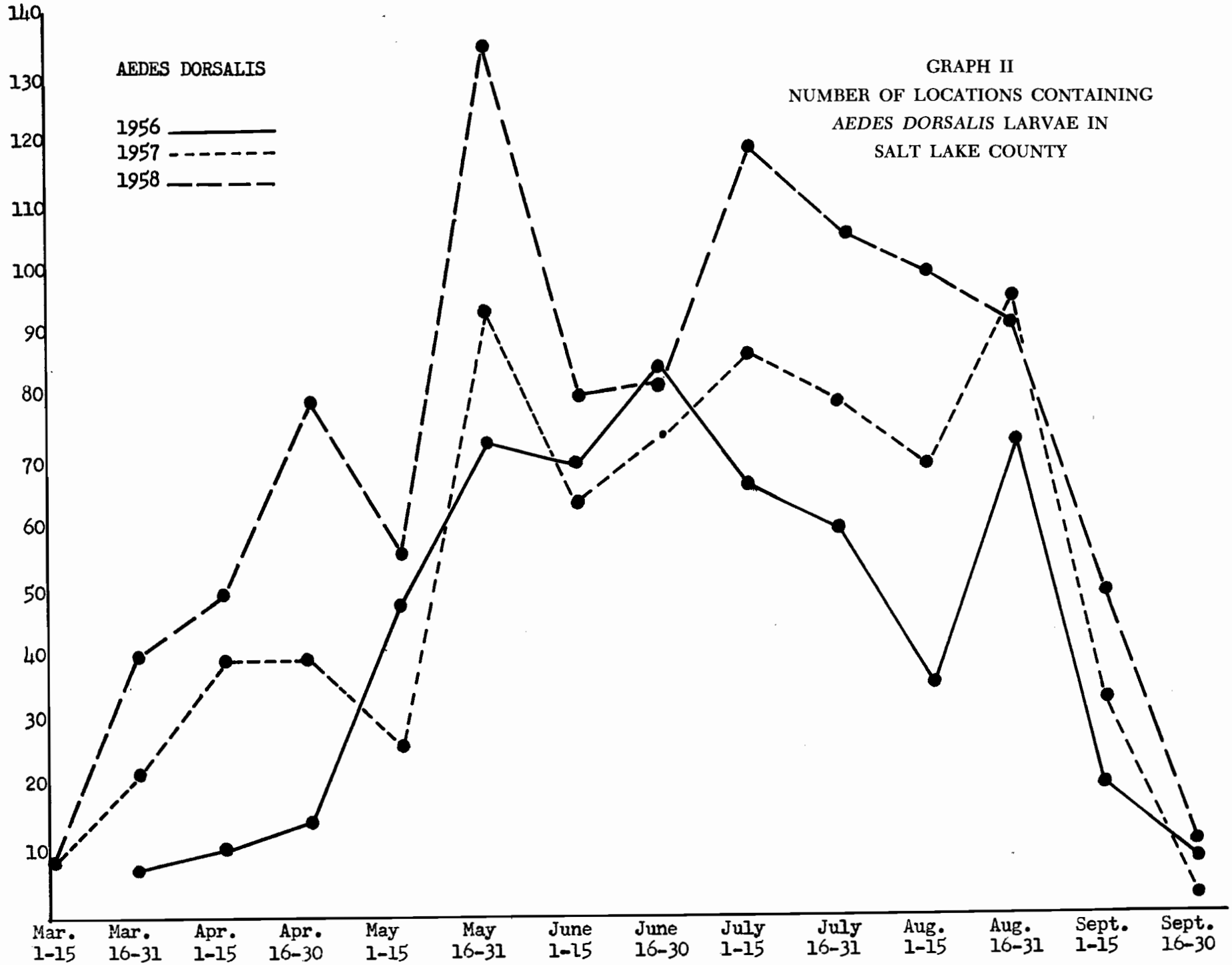
GRAPH I

NUMBER OF LOCATIONS CONTAINING

CULEX TARSALIS IN SALT

LAKE COUNTY



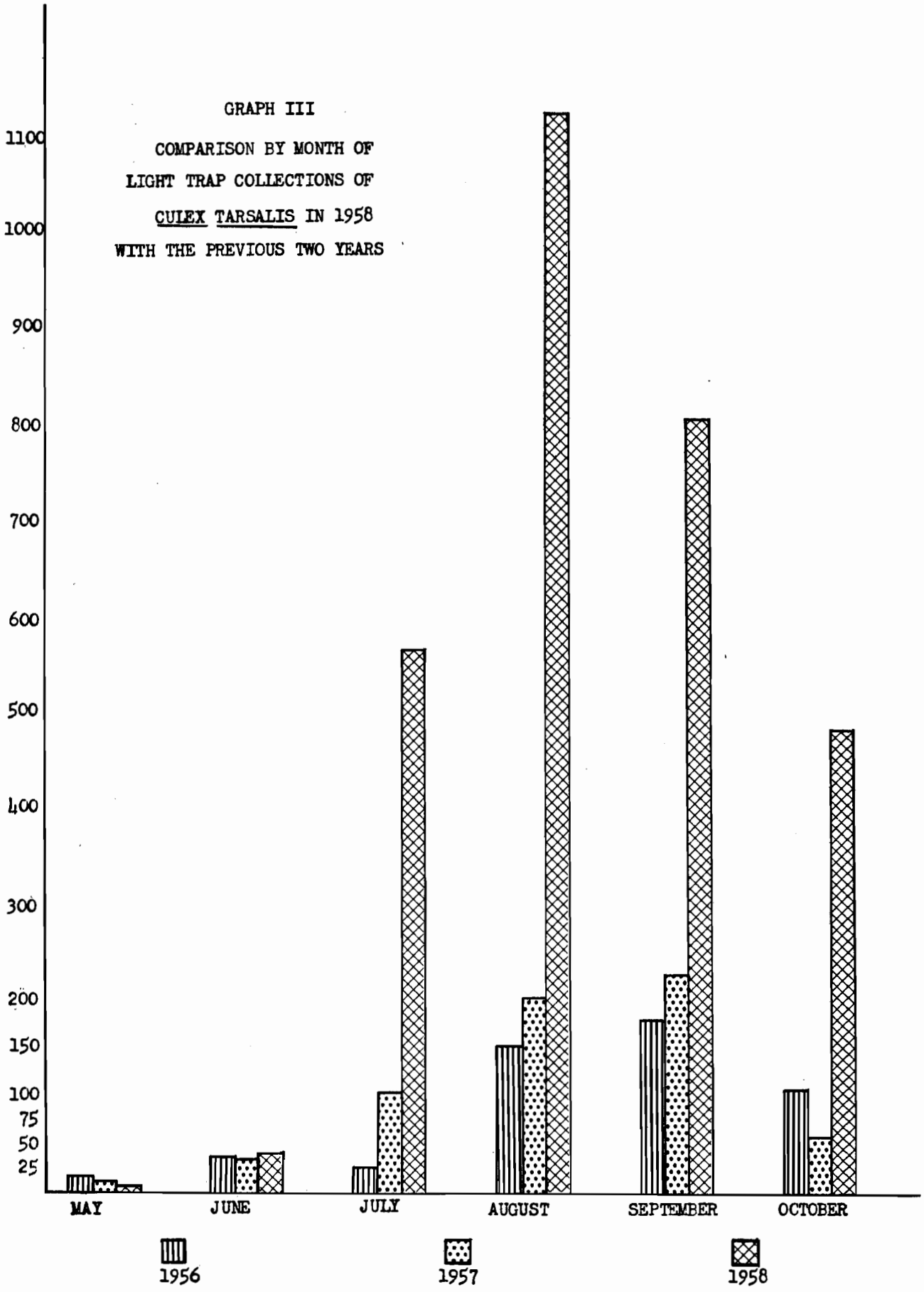


GRAPH II

NUMBER OF LOCATIONS CONTAINING *AEDES DORSALIS* LARVAE IN SALT LAKE COUNTY

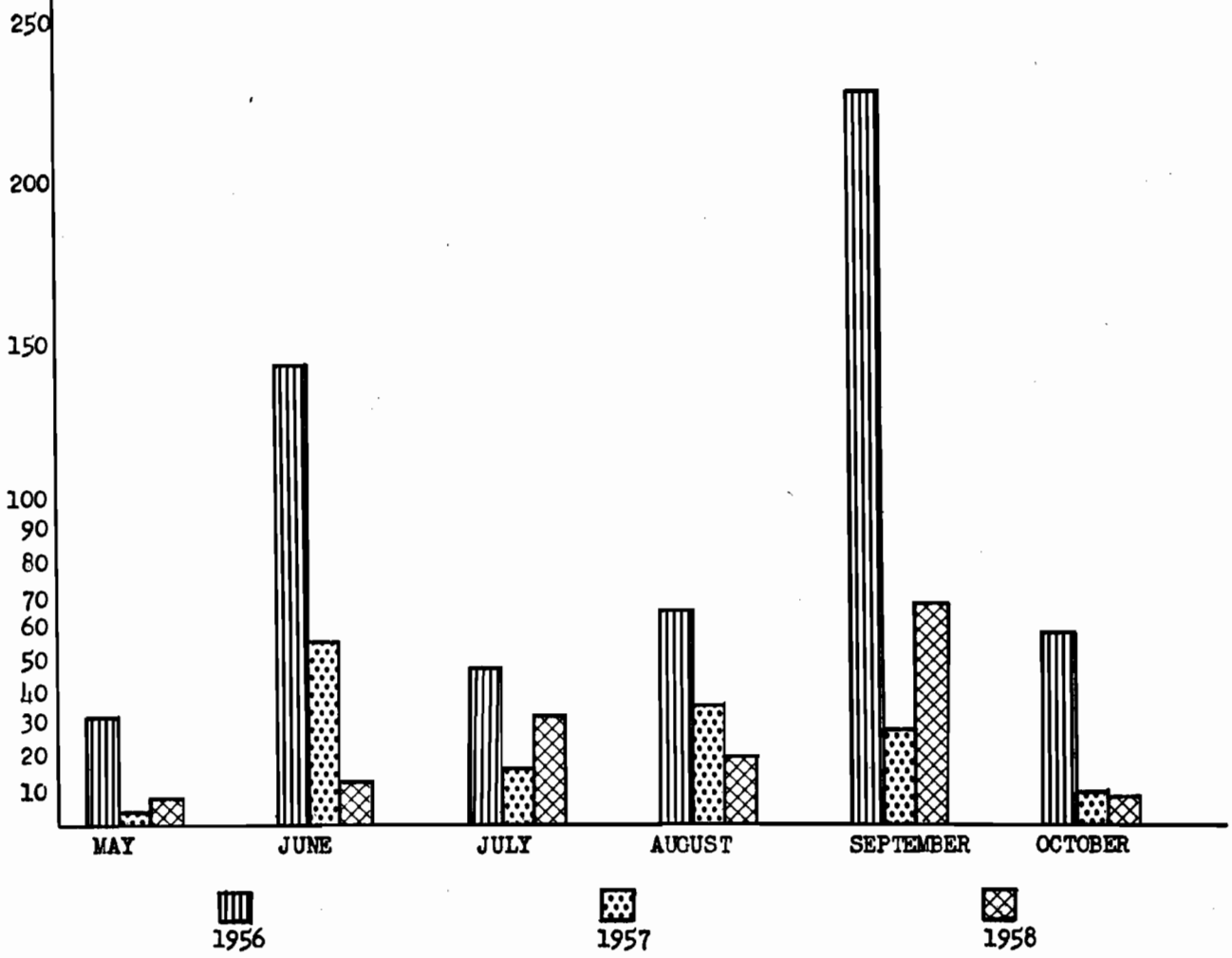
GRAPH III

COMPARISON BY MONTH OF LIGHT TRAP COLLECTIONS OF CULEX TARSALIS IN 1958 WITH THE PREVIOUS TWO YEARS



GRAPH IV

COMPARISON BY MONTH OF
LIGHT TRAP COLLECTIONS OF
AEDES DORSALIS IN 1958
WITH THE PREVIOUS TWO YEARS



From reports on the mosquito populations in 1958, obtained from other counties where the cases of virus encephalitis appeared, conditions were similar to those in Salt Lake City and County. A tremendous increase in the numbers of *C. tarsalis* mosquitoes apparently took place in these counties also, with only a moderate and expected variation in the populations of other species of mosquitoes present.

Comparative collection data for each of the eight light traps operated in Salt Lake City are contained in Graph V.

It is evident in Graph V that a general marked increase occurred in the *C. tarsalis* mosquitoes collected in 1958 in all traps. The greatest numbers were taken in traps #6 and #7 which are located in more suburban areas on waterways closer to the larger open marshes than the other six traps. The greatest increase percentage wise, over the previous two years, took place in the traps in more urban locations. From the light trap collection data contained in Graph V the origin, dispersal, and abundance of *C. tarsalis* in Salt Lake City in 1958 seems to have been widespread and fairly uniform. This pattern was evidently similar in other counties where the encephalitis outbreak occurred.

This marked increase in the *C. tarsalis* population in 1958 and the accompanying outbreak of encephalitis were unexpected, as mosquito abatement districts were functioning in all of these counties except Cache. In most of these districts, *C. tarsalis* had been successfully controlled for many years, and it seemed highly improbable they would fail to respond satisfactorily to the same control measures in 1958. When mosquitoes began to increase in the abatement districts, the people living in these areas were loud in their protests and demands that something should be done to reduce the numbers, especially after news of the encephalitis outbreak and the role mosquitoes serve in its distribution became public knowledge .

The Utah State Department of Health in early August, requested the USPHS to make a study of the situation and report their findings and recommendations to improve existing conditions and prevent a recurrence in the future.

Dr. Rudolf Donath and Louis J. Ogden of CDC, USPHS made the study assisted by other members of that service and by personnel of local health agencies and mosquito abatement districts. To date the final report has not been released, but recommendations and assistance were provided as the study progressed and the outbreak of encephalitis and the number of mosquitoes subsided. Information in some of the above and the following tables was submitted to the Utah State Department of Health by the USPHS and obtained from this source.

Biting counts were obtained during this survey starting 30 minutes after sunset and continuing for one hour. *Culex tarsalis* females were collected in all areas in far greater numbers than all other species combined. *Aedes dorsalis* females were second in the numbers collected. The highest numbers of *C. tarsalis* were taken in Davis County with 131 as the greatest number collected in any one hour period.

During the survey pools of female *C. tarsalis* mosquitoes were collected and tested for the presence of the virus. Results of this sampling is contained in Table 2.

TABLE 2

ENCEPHALITIS INVESTIGATIONS

ENCEPHALITIS SECTION–CDC

GREELEY, COLORADO

Summary of Virus Isolations from *Culex tarsalis* Pools[1]–1958

(Tests made by mouse inoculation)

Location	*Number of Pools Collected*	*Number of Pools Tested*	*Number of Pools Positive For WEE Virus*[4]
Wellsville, Utah	5[2]	4[2]	1
Bothwell, Utah	25[3]	24	5
Deweyville, Utah	2	2	0
Brigham City, Utah	3	2	0
Roy, Utah	1	1	0
Kaysville, Utah	2	1	0
Bountiful, Utah	7	0	0
Magna, Utah	1	0	0
TOTALS	46	34	6

[1] 50 mosquitoes per pool
[2] 2 pools of *Culiseta inornata*
[3] 1 pool of *Culex pipiens*
[4] All positive pools were *Culex tarsalis*
No pools positive for SLE virus

It is evident from these data that wild *C. tarsalis* mosquitoes were infected with the virus during this period.

Thus far it has been established: (1) There was in Utah in 1958 a recognized outbreak of Western Equine Encephalitis in man; (2) It was accompanied by a tremendous increase in the numbers of *C. tarsalis* mosquitoes; (3) *Culex tarsalis* mosquitoes were avidly feeding on man in considerable numbers during this period; and (4) some *C. tarsalis* mosquitoes were harboring the Western equine strain of encephalitis virus.

All of these factors influenced the encephalitis outbreak in Utah. No attempt will be made in this paper to account for the source of the virus or the environmental or climatic requirements essential for its transmission. These factors will be considered in a planned symposium for the AMCA meetings in April. The presence of the great numbers of *C. tarsalis* mosquitoes in Utah in 1958 seems to have had a direct association with the appearance of the encephalitis outbreak. This situation seems to be the same pattern of association occurring in outbreaks of encephalitis in California. An attempt will therefore be made to explain the factors responsible for the great increase in the numbers of *C. tarsalis* occurring in Utah during 1958 as an essential requirement for the encephalitis outbreak in man.

Female *C. tarsalis* mosquitoes were exposed to a mild winter in 1957-58 in the valleys of Utah at all lower

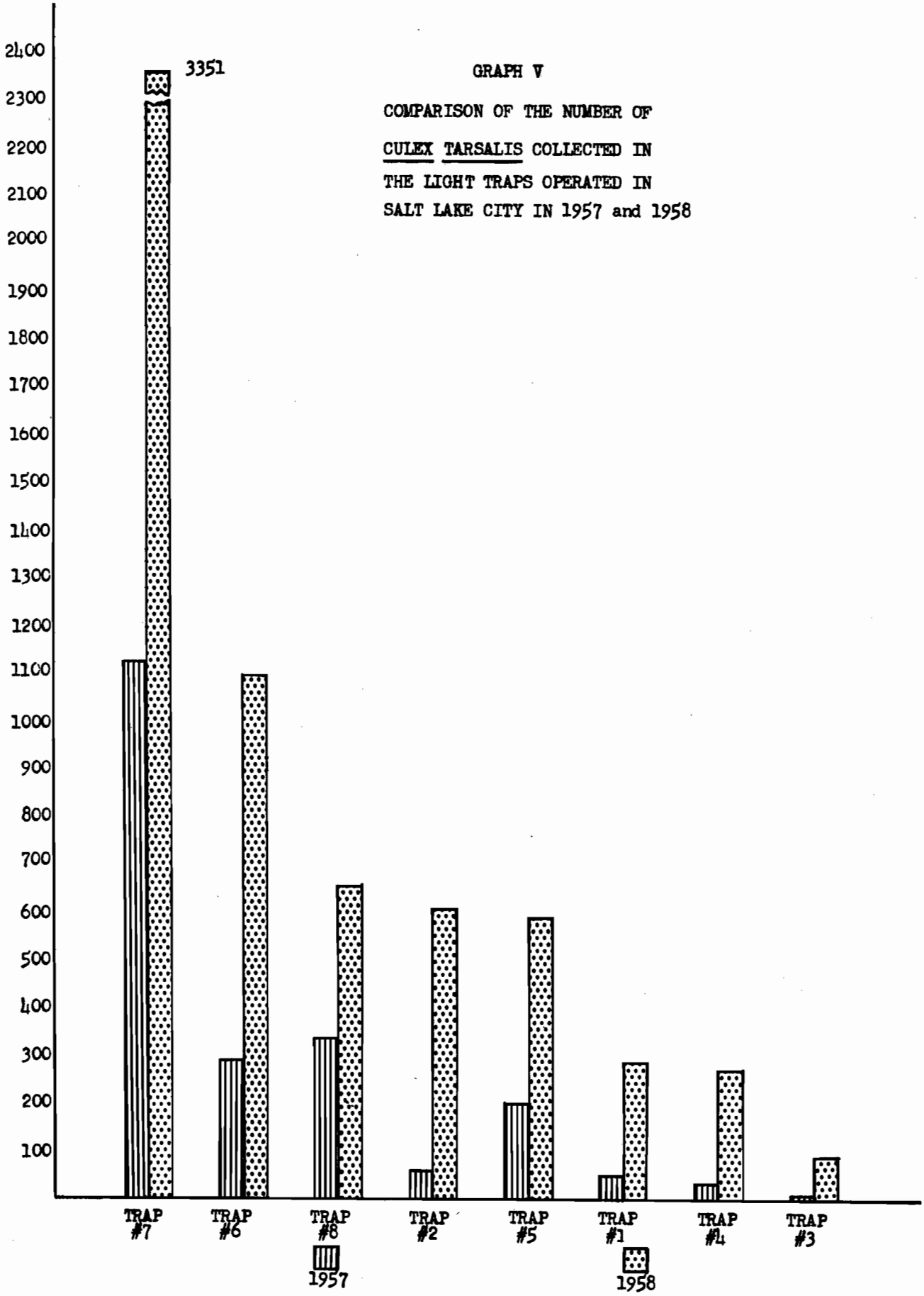
GRAPH V

COMPARISON OF THE NUMBER OF

CULEX TARSALIS COLLECTED IN

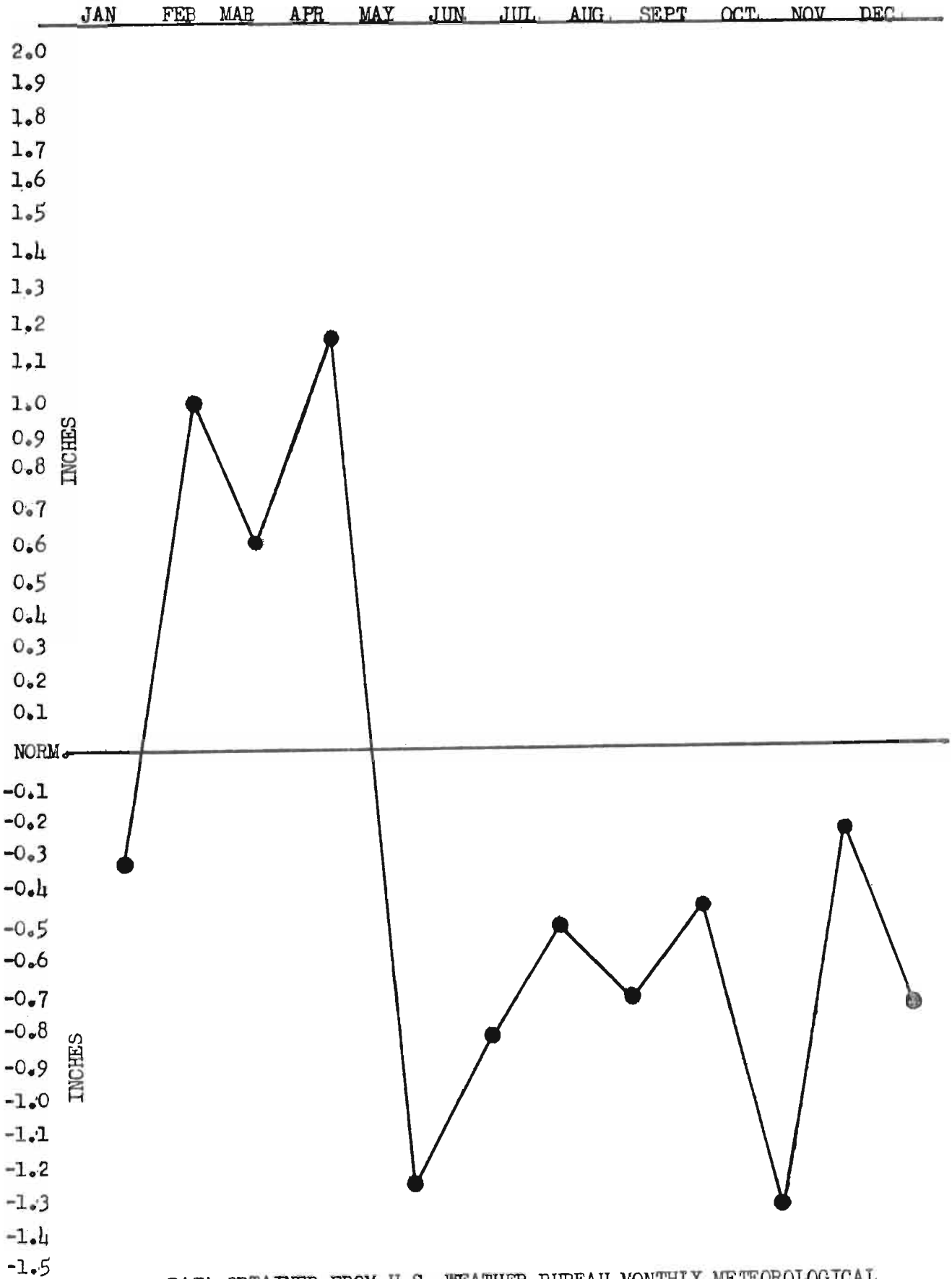
THE LIGHT TRAPS OPERATED IN

SALT LAKE CITY IN 1957 and 1958



GRAPH VI

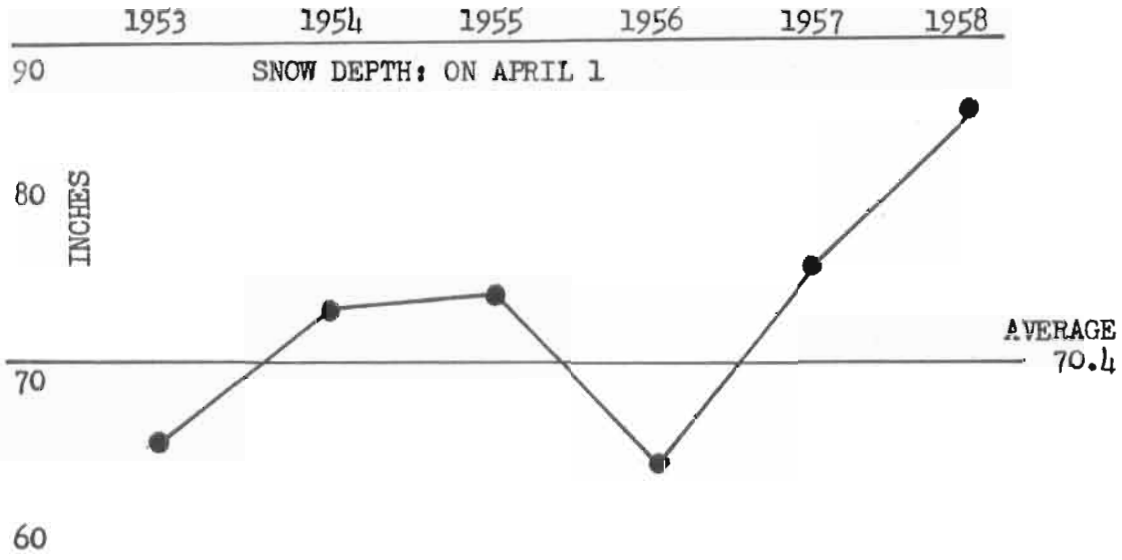
1958 PRECIPITATION IN INCHES DEVIATION FROM NORMAL



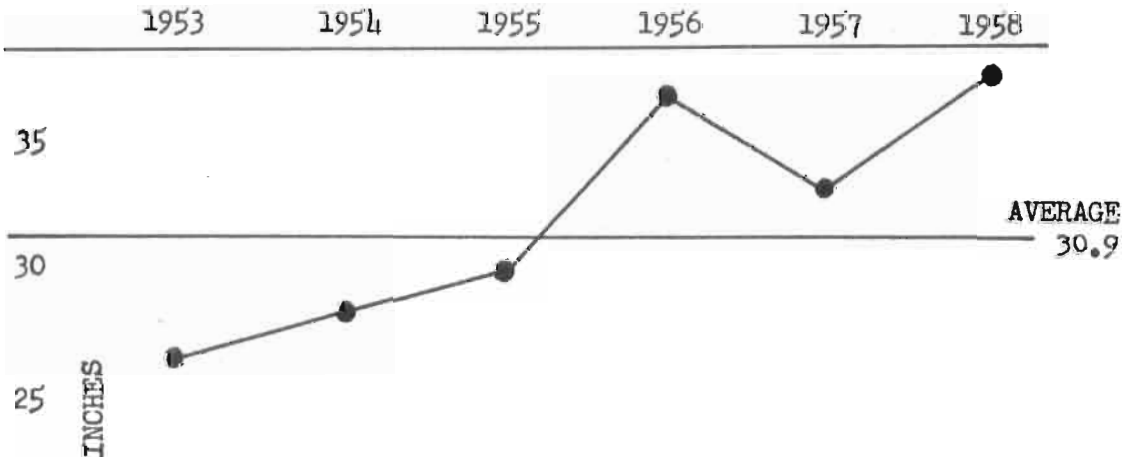
DATA OBTAINED FROM U.S. WEATHER BUREAU MONTHLY METEOROLOGICAL SUMMARIES, SALT LAKE CITY, UTAH (AIRPORT STATION)

GRAPH VII

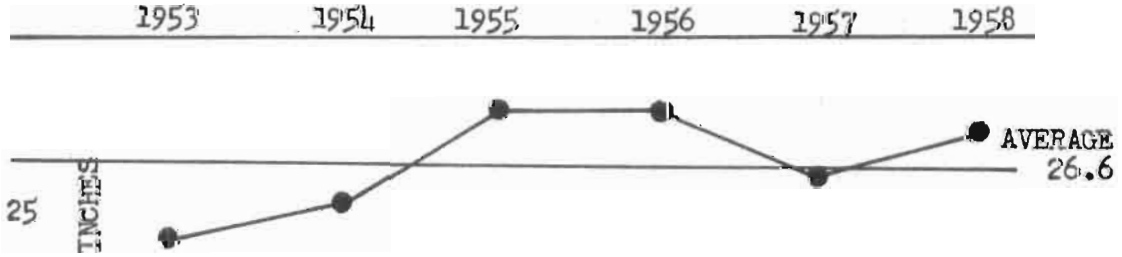
MEASUREMENTS AT SILVER LAKE,
BRIGHTON, UTAH. ELEV. 8729 ft.



PRECIPITATION: OCT 1 to APR 1



WATER CONTENT: ON APRIL 1



elevations. These climatic conditions were favorable for the survival of over-wintering females. The mean temperature in the Salt Lake valley in January and February was considerably above normal. In February, 1958, the second highest mean temperature was recorded for this month since temperatures have been recorded in this area. Spring came early with a corresponding early appearance of *C. tarsalis* larvae from an unusually large over-wintering brood stock of this species. The spring and summer months were exceptionally hot and extremely low in rainfall. The high temperatures accelerated the development of the larval and pupal stages and shortened the time required between generations. All of these factors were extremely suitable for a rapid buildup of the *C. tarsalis* mosquito population. Some of these factors were equally conducive for a build up of other species of mosquitoes but other factors, not discussed in this paper, prevented an appreciable increase in the apparent numbers of other common species such as *Aedes dorsalis*.

The water requirement for mosquito larvae is always an important factor in a semi-arid region such as Utah. It is evident in Graph VI the total precipitation from May to September was less than one inch when the normal precipitation is nearly four inches for this period. It is at first difficult to account for adequate water to produce this abnormally large population of *C. tarsalis* in 1958.

In a re-examination of this graph it is evident that in February, March and April the precipitation was considerably above normal. During this period the snow pack is deposited in the high mountains of Utah from which much of the water in the valleys is obtained during the summer months. The snow pack, water content and total amount of precipitation in inches as recorded at the Silver Lake Station in the Wasatch Mountains is presented in Graph VII.

The water in the snow pack and the total precipitation was above normal in the mountains and provided adequate water for use in the valley during the hot dry summer. The hot dry spring and summer months in the valley necessitated the use of greater quantities of water for all water requirements. As a result more continuous and greater quantities of water were used during this season. This created many additional water filled places suitable for the development of *C. tarsalis* larvae. In a season less hot and dry, or in a season with a water shortage, these areas would have been dry and unproductive of mosquitoes.

Other factors such as greater resistance of this species to the insecticides used; the lack of personnel adequate to provide satisfactory control measures to check the increase once it started expanding; and possibly other unknown factors may have contributed to the increase of this species. Evidently a combination of many factors was responsible for the increase but those mentioned undoubtedly were a major influence in bringing about the tremendous increase in the *C. tarsalis* mosquitoes and to that extent the outbreak of encephalitis in Utah in 1958.

References

Loomis, E. C., 1953 "Population trends of *Culex tarsalis* in the Central Valley of California," Proceedings and Papers of the Twenty-first Annual Conference of the California Mosquito Control Association, pp. 73-75.

Loomis, E. C., 1955 "Adult mosquito occurrence and human infection encephalitis cases in California," Proceedings and Papers of the Twenty-third Annual Conference of the California Mosquito Control Association and the Eleventh Annual Meeting of the American Mosquito Control Association. pp. 51-52.

Dr. Barr: All of this must seem very familiar to you in California who have been working on similar problems for such a long time. Our next paper is by Dr. William C. Reeves of the University of California at Berkeley, and is entitled: "The Next Step in Encephalitis Research in California." Dr. Reeves.

Dr. Reeves: Thank you, Ralph. The first preface that I have to say is that I do not have any slides to show today. Perhaps there is a reason for this. All I have is a large word that Gordon Smith referred to earlier. I have changed the title of this paper a little in order not to get it too diversified. I have changed it to "The Next Step in Encephalitis Research in *Kern County* in California.

THE NEXT STEP IN ENCEPHALITIS RESEARCH IN KERN COUNTY*

WILLIAM C. REEVES, PH.D.
Professor of Epidemiology
School of Public Health, University of California, Berkeley

A rapid review of past developments and accomplishments in encephalitis research in California seems a logical preface to consideration of future plans. Sixteen years ago we knew practically nothing about this problem if we judge by modern standards. In the interim, extensive advances have been made in knowledge of: the types of causative viruses, the primary vector *(Culex tarsalis)*, the principal animal sources of infection (wild birds), the incidental involvement of man and horse as hosts to these viruses, the dependence of the vector and viruses on climatic factors, overwintering of the viruses and vector, and many other aspects of the problem which were previously unknown. These research developments have been slow in terms of the years and effort involved. Also, the number of contributing persons and agencies has been extensive. In looking back on the evolution of these advances certain things become obvious. Most of us tend quickly to relegate new research findings into our arsenal of everyday knowledge for practical use if applicable, and then proceed to concern ourselves with what we do not know or think we need to know which means more research investigation. This process leads to advances. However, it is also valuable at times to test our findings and concepts to determine their adequacy.

I would like to utilize our current knowledge for pur-

* The research reported in this paper represents a cooperative project between the: Encephalitis Section, Communicable Disease Center, USPHS; the Bureau of Vector Control, California State Department of Public Health; the Kern Mosquito Abatement District and the School of Public Health, University of California. These studies were supported in part by a research grant from National Institute of Allergy and Infectious Diseases, N.I.H., U.S.P.H.S.

poses of interpreting the Western equine encephalitis (WEE) epidemic potential last summer in Kern County and to use this as an illustration of how far we have progressed in our knowledge. This will not be a detailed report, as data analysis and laboratory work are still in progress, however, we are far enough along for a preliminary and I believe revealing review.

Encephalitis Epidemic Potential 1958, Kern County

As most of you know the epidemic potential last May and early June was viewed by some of us with considerable concern. The basis for this concern in Kern County was the knowledge by June 1 that:

1. Water availability from natural sources, heavy spring rain and heavy snow pack, was well above normal. A surplus of available river water, and the need to prevent flooding of valuable crops, led to river margin flooding and purposeful flooding of many sections of unimproved land.
2. *Culex tarsalis* responded to and utilized this available source of water and by May an adult population comparable to that of 1952 had developed in both urban and rural areas in spite of an all-out effort by the control agencies.
3. It had to be assumed, that WEE virus was present in this area and available to the vector population.
4. Susceptible bird hosts were present in large numbers and readily available to the vector.
5. Large susceptible human populations were present in both urban and rural areas.
6. The horse population was too sparse and immune to offer much risk of a large epizootic.
7. Average daily temperature above 80° F. had not occurred but could at any time. Temperatures in this range seem to be essential for effective high levels of transmission of WEE virus.

Any time the above circumstances prevail in a local or valley-wide situation those of us familiar with past experiences and research in this field are going to view the situation with alarm. A research project to study this situation was organized quickly and begun the first week of June, the results available at this time are quite interesting and are best summarized by the following points:

1. WEE virus infection rates in the *C. tarsalis* population were extremely high in early June with an infection rate above 1:100 specimens tested. In the first two weeks of sampling, virus was isolated from collections from 6 of 9 urban Bakersfield collecting stations and 22 of 26 rural stations. Thus virus activity and availability were high and widespread. This even included 2 isolations of WEE virus from *C. tarsalis* collected inside Dr. Bellamy's residence.
2. At the same time that vector infection rates were being measured, sentinel chickens were exposed to vector attack in the field to determine the vector's ability to transmit. Only 3 of 44 chicks became infected in single night exposures in the first 3 weeks in June, then at the end of June, 4 of 12 chicks became infected in a single night's exposure and transmission rates remained high through July. These findings illustrated dramatically the difference between the infection of mosquitoes and their ability to transmit. The majority of chicks in the first 3 weeks were bitten by infected mosquitoes, but most of the vectors were incapable of transmission. St. Louis encephalitis (SLE) virus did not become active until August.
3. Observations of vector attack rates on chickens and a sample of persons revealed a very high degree of vector feeding on these 2 hosts. In rural areas an average of over 100 *C. tarsalis* were attracted to and bit each chicken per night in June. Interview and physical examination of 260 persons in June revealed a history of mosquito attack in 61 per cent and attack in the past 24 hours in 19 per cent. The history of mosquito attack was highest in the rural residents but also quite high in the urban residents. Of those with a history of when and where bitten, 89 per cent were attacked after sundown and 47 per cent indoors—a rather clear incrimination of *Culex*. If the *C. tarsalis* had been highly infective numerous persons would have become infected.
4. *Culex tarsalis* control was most difficult and incomplete until mid-June when the intensive efforts finally caught up with the problem and particularly in the urban area of Bakersfield. By the end of June and through the remainder of the summer few *C. tarsalis* could be found in the urban area.
5. Confirmed human cases occurred in much smaller numbers than originally were anticipated. There were 15 WEE and 2 SLE cases. This was markedly fewer cases than in the 1952 epidemic, 100 WEE and 16 SLE. However, it is a substantial increase in the number of WEE cases over the number occurring in the past 5 summers. Only 5 WEE cases occurred in June and of these 3 were urban residents.
6. There were 17 suspected clinical cases in horses, a small number as was expected, but this surpassed the total number of cases during the entire preceding 5 years. Fourteen of the cases had onsets in June.
7. Large numbers of chickens from urban and rural flocks were bled to be tested for antibodies. Forty rural birds were bled the first week of August and the survivors again in October. In August, 48 per cent were WEE positive and in October, 70 per cent of these birds had been infected. In contrast none were positive for SLE in August but 57 per cent were in October. This very dramatic seasonal difference between WEE and SLE virus activity was fully confirmed by the seasonal occurrence of the viruses in mosquitoes and man.
8. As you remember average daily temperatures were suggested to be a critical factor in determining the rate of virus transmission. Sustained daily average temperatures over 80° F. were delayed until the latter half of June. In contrast, in 1952 these temperatures occurred in May. Up to this time the only identifiable factor which prevented a WEE epidemic in the Kern County area in early June was temperature which quite probably suppressed the incubation of virus in the vector.

From the preceding preview of current data it can be seen that we have many tools and considerable insight into the circumstances surrounding the transmission of the encephalitis viruses.

I will not attempt to review the extensive current studies on the overwintering of WEE and SLE viruses in California. Much of the data and interpretations have been published (Bellamy *et al.*, 1958; Reeves *et al.*, 1958a and b). Sufficient to say that it appears that WEE and possibly SLE viruses are being maintained on a constant basis in California without a need for annual or periodic reintroduction. There are two primary ways by which these viruses may survive the winter and there are experimental and field data to support both possibilities. The first is that some of the many birds infected each summer survive to the following year and have a persisting chronic latent infection. The second possibility is that overwintering *C. tarsalis* carry the infection.

With the preceding background I would like now to preview what we consider to be the logical next steps in encephalitis research in our program. I must emphasize that there is no implication that other workers and organizations are not making equally important contributions or that their plans for future research are unimportant or illogical. Rather, we have had to make decisions of how and where we will next apply our resources.

Future Program

We feel it is important and essential to continue the studies of alternative possibilities that might account for virus overwintering. Until this phenomenon is thoroughly understood we will have an extensive gap in our knowledge of the biology of these infections and will have no opportunity to evaluate the potentialities of control measures which might be applicable at times when the several viruses are dormant.

Extensive and promising efforts are being made to develop techniques for the identification of blood samples from various bird species. An ability to determine accurately the avian hosts fed on by *C. tarsalis* would provide an invaluable tool for determining the relative importance of the numerous bird species as both overwintering and summer hosts to the arthropod-borne viruses.

A most difficult and probably our principal research effort for the next several years will be the carrying out of an experimental demonstration of the effect of *C. tarsalis* control on the transmission of WEE and SLE viruses. The majority of this audience is obviously surprised at the need for such a program and I am to some degree. Most workers in California have accepted the fact that *C. tarsalis* control is equivalent to WEE and SLE control. Research data and practical experience support acceptance of this fact. However, there still has not been a carefully designed and observed experimental demonstration with adequate controls. The values of such a demonstration would be numerous. Of particular value would be: confirmation of the extensive evidence that *C. tarsalis* is the primary vector in a representative area of California, opportunity to determine the lower limits of a *C. tarsalis* population where transmission ceases, and perhaps a unique opportunity for follow-up study of the persistence of virus in reservoir hosts in an area where active transmission has been halted.

Three experimental areas have been selected in Kern County for this study. These are rural farming areas. Each area is 10 to 20 square miles in size, linear in shape, intensively irrigated and bordered by desert on at least 2 sides. The encephalitis viruses are highly endemic in these 3 areas.

The second year of comparative measurements of the 3 areas has been completed, and will be continued for one more summer. The following basic data are being collected from each area, each week of the summer.

1. Adult vector populations as measured by light traps, bait traps and red box standard shelters.
2. Vector infection and transmission rates.
3. Wild bird populations.
4. Mosquito larva sources.
5. Seasonal measures of avian host infection by: serological testing of chicken flocks, and virus isolations from serological testing of wild birds.

Comparison of the resulting multiple types of data from past summers indicate that these 3 areas are very comparable. A third summer's confirmation of their comparability should suffice, and the vector control phase of the project will begin. It is intended to concentrate a most intensive and complete *C. tarsalis* larval control program in one of the areas with the other 2 relatively uncontrolled areas serving as a check on the continuing activity of the viruses. It remains to be determined if the necessary financial support and personnel can be obtained for completion of this final phase of the program. Currently the project represents a combined effort with the full cooperation of: the Kern Mosquito Abatement District, the Encephalitis Section of the Communicable Disease Center, the Bureau of Vector Control and the School of Public Health of the University of California.

References

Bellamy, R. E., W. C. Reeves and R. P. Scrivani, "Relationships of mosquito vectors to winter survival of encephalitis viruses. II. Under experimental conditions," *The American Journal of Hygiene* 67(1):90-100, January, 1958.

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Reeves, W. C., G. A. Hutson, R. E. Bellamy and R. P. Scrivani, "Chronic latent infections of birds with Western equine encephalomyelitis virus," *Proceedings of the Society for Experimental Biology and Medicine* 97:733-736, 1958.

Dr. Barr: Thank you, Bill, for this very interesting review of the work of last year and a look toward the future. The last paper scheduled for this morning is in the way of an announcement of a seminar of the CMCA which will be held shortly in Riverside. This will be made by Leon L. Hall, Chairman of the Entomology Committee of the CMCA, and the title of his presentation is "Highlights of the 1958 California Mosquito Control Association Entomology Seminar and Plans for the 1959 Seminar." Leon.

Mr. Hall: Mr. Chairman, members of the tired audience, those that are anxiously waiting to leave as soon as this is over, if you will stay long enough for that.

Actually this is the paper that everyone looks for, so I hope it isn't too boring so that we can at least stimulate a few of you to come back to our other conferences.

Note: Mr. Hall presented an extemporaneous summary of the 1958 Entomological Seminar and plans for the 1959 seminar. The summary is included in the Report of the CMCA Entomology Committee included in the Third Session of this Proceedings.

Dr. Barr: Thank you, Leon. At this point I would like to turn the meeting back to Gordon Smith and have the adjournment and any final announcements from him.

Pres. Smith: I know that you all want to go home now, so I will make this as brief as possible. Ed, have you got any announcements that you would like to make? I have a few.

First, we will, as soon as possible, get copies of the resolution concerning subvention out to all Districts so that they can take individual action on this matter.

Secondly, and this isn't any collusion with the Entomology Committee, a board meeting of the Board of Directors of the Association has been called for the last Thursday of March at the Southeast District. It happens to fall on the 26th of March, the day before the announced dates for the Entomology Seminar. That is strictly out of the air.

There was considerable discussion on the budget and confusion so that we didn't get anything done. As soon as Ed and his bank and his auditor get the finances straightened out, we will attempt to get a preliminary budget out, and we would like the different areas to be prepared to sit down and discuss that seriously. As I recall the action or recommendations of the Committee and the Board of Directors was approved yesterday, so the area representatives are the Budget Committee. Get together with your representatives, get your ideas across, and be prepared to come down there and discuss the budget, compromise if necessary, so that we can straighten it out.

I think that we should offer thanks—apparently there was no Committee appointed to make up resolutions—at least offer our thanks to the Monterey Convention Bureau, to the Mark Thomas' Inn, and to all the people who were kind enough to participate on our program this year. That is all I have. I think we should adjourn in honor of Howard Greenfield, who has set a record for entering his second childhood. May he have a happy old age, and we will now adjourn. See you all in Utah.