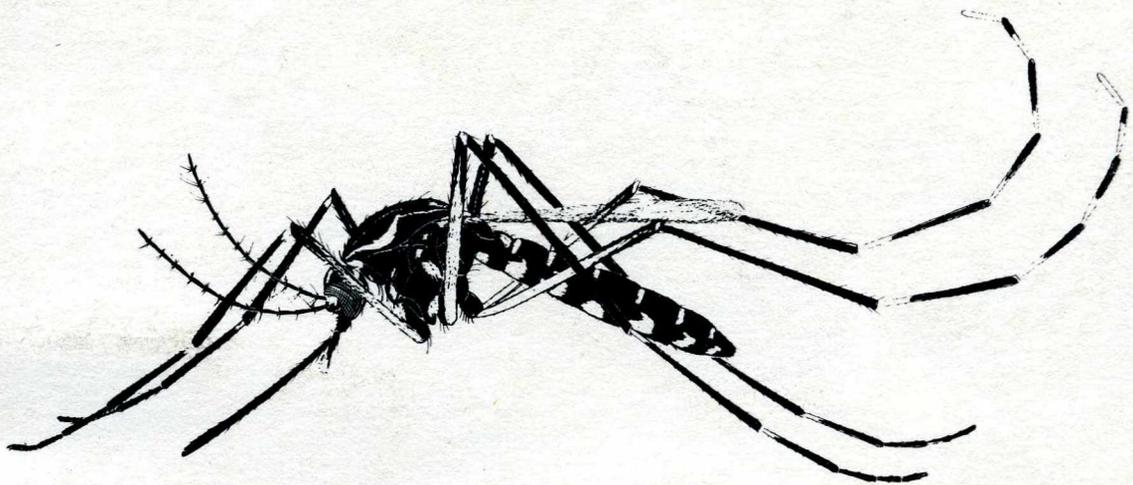


AEDES AEGYPTI ERADICATION PROGRAM
MANUAL OF OPERATIONS

PART I



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

194

**Aedes aegypti Eradication Program
Manual of Operations**

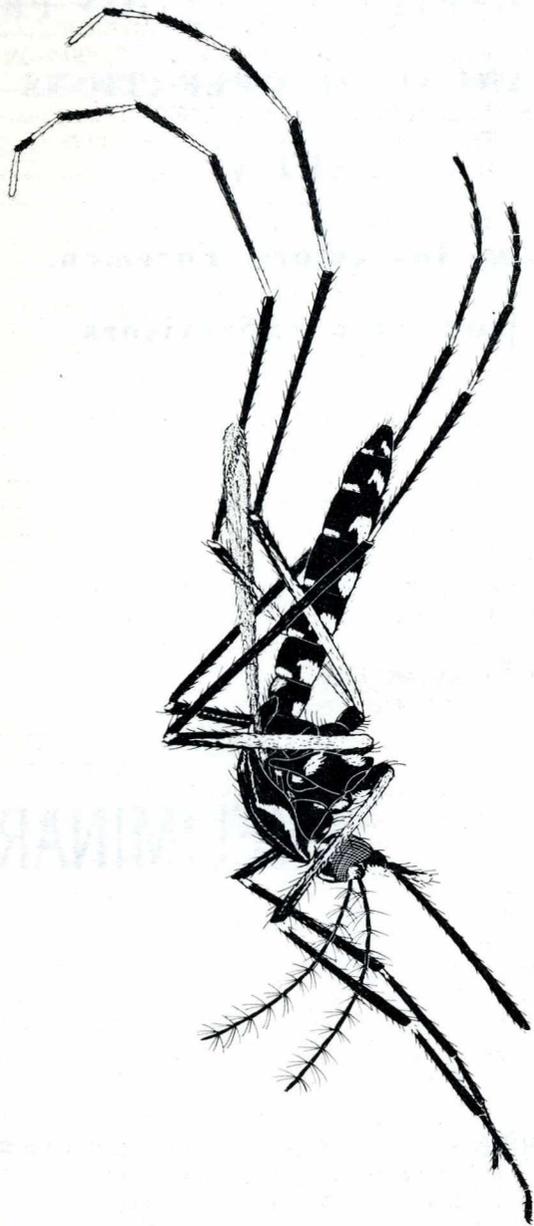
Part I

**For Inspectors, Foremen,
and Area Supervisors**

PRELIMINARY ISSUE

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
Communicable Disease Center
Aedes aegypti Eradication Branch
Atlanta, Georgia
May 1964

THE YELLOW FEVER MOSQUITO
Aedes Aegypti



TRANSMITS YELLOW FEVER AND DENGUE

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
Communicable Disease Center
Aedes aegypti Eradication Branch
Atlanta, Georgia 30333

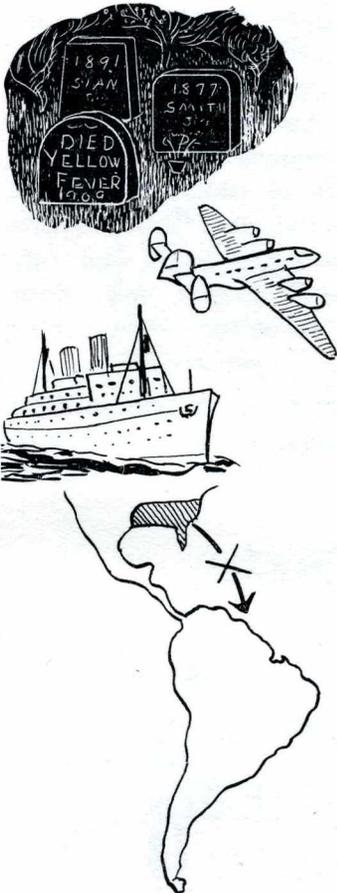
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INTRODUCTION

PURPOSE

Eradication of the yellow fever mosquito (*Aedes aegypti*) from the United States, Puerto Rico and the Virgin Islands will:



1. Eliminate the hazards of epidemics of yellow fever and dengue;

2. Increase the effectiveness of continuing foreign quarantine;

3. Assure that *Aedes aegypti* will not be exported from the United States to other countries from which it has been eradicated (and where it constitutes a greater hazard because of the proximity of jungle yellow fever); and

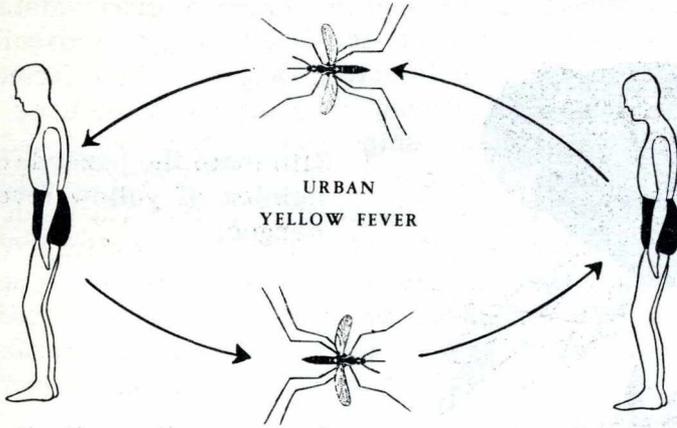
4. Fulfill international commitments of the United States



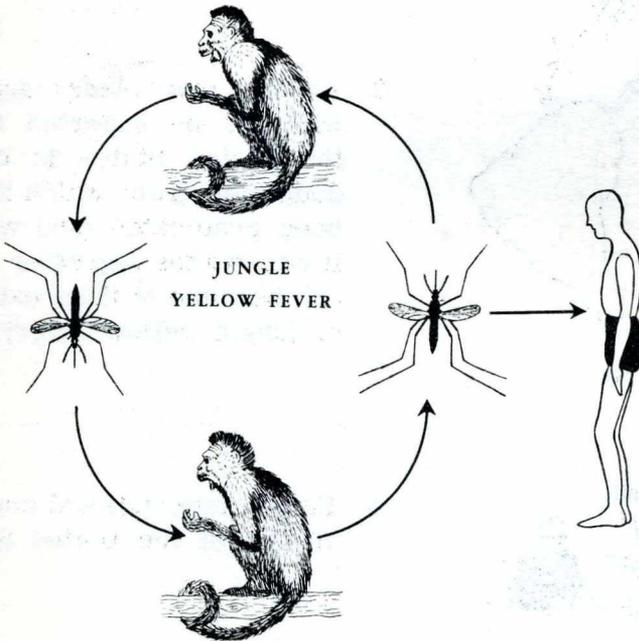
TYPES OF YELLOW FEVER

Two forms of yellow fever caused by the same virus are known:

(1) urban yellow fever, in which the yellow fever virus is transmitted from person to person by *Ae. aegypti* and



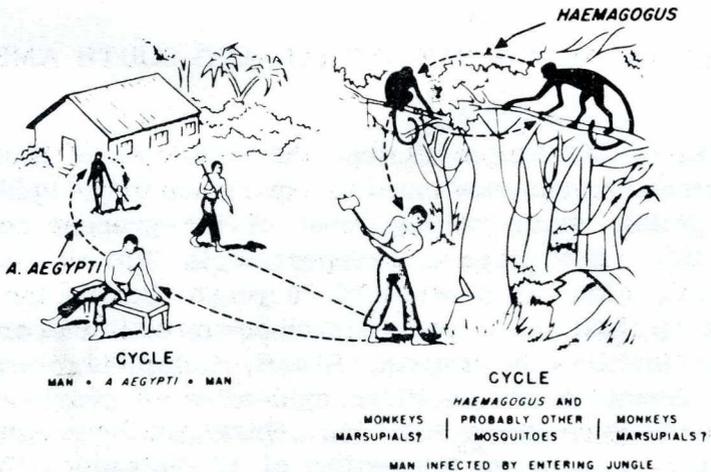
(2) jungle yellow fever, in which the virus is transmitted from monkey to monkey and occasionally from monkey to man by *Haemagogus* and certain other jungle mosquitoes.



The jungle reservoir of yellow fever can be the source of urban outbreaks. When a person becomes infected in the jungle and returns to a settlement where *Aedes aegypti* is present, these mosquitoes may feed on his blood, become infected, and transmit the virus to other persons. A number of human epidemics of urban yellow fever in Latin America have been initiated in this manner in recent years.

Yellow fever virus can be carried great distances in man, in monkeys, or in *Aedes aegypti* mosquitoes. Once *Ae. aegypti* are infected, they remain infected for life. Despite precautions, mosquitoes sometimes gain access to airplanes, ships, and automobiles and are transported from one community or country to another. If infected *Ae. aegypti* are carried in this way to an area with susceptible people and sizeable populations of *Ae. aegypti*, they can initiate epidemics. Likewise, a person who has been exposed, or an infected monkey in shipment, can travel great distances during the incubation period, then serve as a source of infection far from the place of exposure.

JUNGLE YELLOW FEVER - SOUTH AMERICA



JUNGLE TO URBAN

MAN GOES INTO JUNGLE, BECOMES INFECTED, RETURNS HOME, AND IF *A. AEGYPTI* ARE PRESENT MAY INITIATE THE URBAN OR MAN-MOSQUITO-MAN CYCLE

YELLOW FEVER IN THE UNITED STATES

In the United States, devastating epidemics of yellow fever occurred during the period from 1668 to 1905, striking communities from Texas to New England, sometimes repeatedly. For example, Philadelphia suffered 20 epidemics, New York 15, Boston 8, and Baltimore 7. The explosive nature of the outbreaks is illustrated by the 1878 epidemic in Memphis, Tennessee, when approximately 4,000 people died, and by the 1898 epidemic in New Orleans, Louisiana, which produced 13,817 cases and 3,894 deaths. In 1900, Walter Reed and the Yellow Fever Commission definitely established that yellow fever is transmitted by the *Ae. aegypti* mosquito. The last epidemic in this country (1905), with 8399 cases and 908 deaths, struck most heavily in New Orleans, which reported 3,384 cases and 443 deaths. The fact that the 1905 epidemic was much less extensive in New Orleans than that of 1898 was attributed largely to a concerted drive against *Ae. aegypti*.

YELLOW FEVER IN CENTRAL AND SOUTH AMERICA

Unlike the United States, the countries of South and Central America continued to experience urban epidemics of yellow fever during most of the present century. In 1928, the disease reappeared in Rio de Janeiro, Brazil, after an absence of 20 years. During the years 1932 to 1954, urban yellow fever occurred in one or more municipalities in Bolivia, Brazil, Colombia, Paraguay, and Trinidad. In addition, epidemics of jungle yellow fever have occurred in all the Central and South American countries with the exception of El Salvador, Uruguay and Chile.

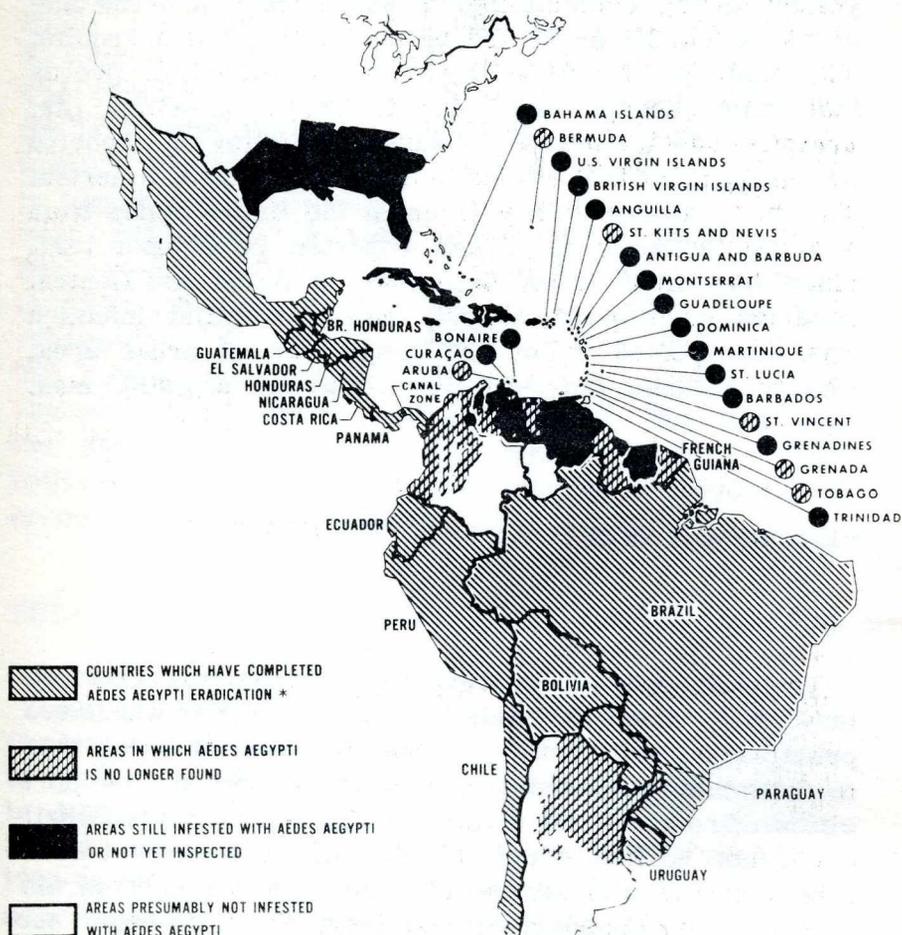
HISTORY OF Aedes aegypti CONTROL AND CESSATION OF EPIDEMICS OF URBAN YELLOW FEVER

Since *Ae. aegypti* is solely responsible for transmission of yellow fever from person to person (urban yellow fever), epidemiologists suspected that urban outbreaks could be prevented by controlling this mosquito. The history of yellow fever in the Americas proves that this concept was correct. Urban epidemics (*Ae. aegypti*-man-*Ae. aegypti*.) disappeared following intensive *Ae. aegypti* control efforts in South and Central America. The last case of yellow fever in the United States from a known endemic area was reported in October 1924. Since that time urban outbreaks in South and Central America have occurred only when an initial infection was transported from the jungle to an urban area, i.e., from jungle mosquito, to man, to *Ae. aegypti* to man.

HISTORY OF Aedes aegypti ERADICATION

The philosophy of *Ae. aegypti* eradication was developed in Brazil, where officials determined that it was more practical to eliminate *Ae. aegypti* from all areas than to maintain permanent control measures in the port cities. From the beginning it was obvious that Brazil could not realize the full value of eradication unless this mosquito was also eradicated from the 10 countries sharing her boundaries; and they, in turn, could not easily be kept free unless the species was eradicated from their adjoining neighbors. To provide lasting protection for any country that achieved eradication meant, therefore, that *Ae. aegypti* must be eradicated from every political unit and island lying between the States of Oklahoma and Tennessee on the north to Buenos Aires on the south.

STATUS OF THE AËDES AEGYPTI ERADICATION CAMPAIGN DECEMBER 1963



* ERADICATION CARRIED OUT ACCORDING TO THE STANDARDS ESTABLISHED BY THE PAN AMERICAN HEALTH ORGANIZATION

Progress in *Aedes aegypti* eradication in this hemisphere is shown on the accompanying map.

Recognizing the importance of international cooperation in efforts to eradicate *Ae. aegypti*, hemisphere-wide eradication was first proposed by representatives of Bolivia in 1942 at the 11th Meeting of the Pan American Sanitary Conference. In 1947 at the first meeting of the Directing Council of PAHO* a resolution concurring in the desirability of such a program was approved. The United States was a signatory nation to this resolution.

Stimulated by epidemics of jungle yellow fever, which occurred from 1948 to 1957 in Central America, eradication programs were initiated by many of the signatory nations and territories of the Pan American Health Organization. Fifteen nations and 2 territories have now achieved eradication. Only certain areas in the United States and the Caribbean remain heavily infested with *Ae. aegypti*.

PUBLIC HEALTH HAZARD TO THE UNITED STATES FROM Aedes Aegypti

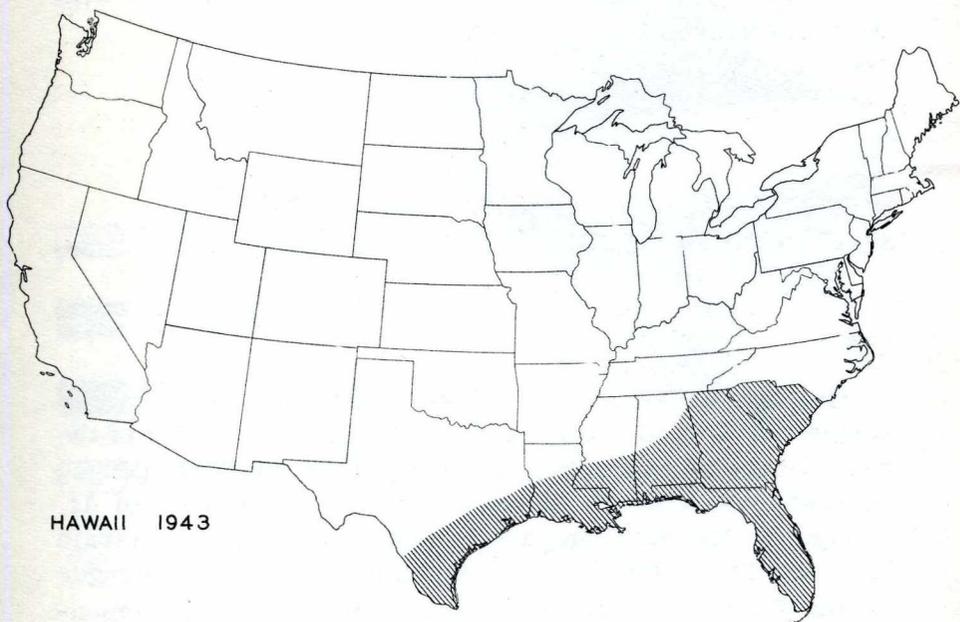
Although epidemics of yellow fever have not occurred within the United States since 1905, the possibility of the recurrence of epidemics of both yellow fever and dengue persists as long as there are large populations of *Ae. aegypti* on the mainland and in Puerto Rico and the Virgin Islands. The extensive and explosive outbreak of dengue in the Caribbean area during 1963-64 adequately demonstrated this threat to public health.

*At that time known as the Pan American Sanitary Bureau.

DENGUE

Dengue, or 'break-bone' fever, also is transmitted by *Ae. aegypti* but has occurred in epidemic proportions in this country more recently than yellow fever. While the fatality rate for dengue is lower than that of yellow fever, it is nonetheless a debilitating disease often characterized by a high attack rate. Notable epidemics of dengue have occurred in 1922 and 1923 in Florida, Georgia, Louisiana, Mississippi, and Texas; in 1934 in Alabama, Florida, and Georgia; in 1941 in Texas; in 1943 in Hawaii; in 1945 in Louisiana; and in 1963-64 in the Caribbean.

AREAS WHERE DENGUE EPIDEMICS HAVE OCCURRED 1922 - 1964



HAWAII 1943

CARIBBEAN 1963-64

PROGRAM OF Aedes Aegypti ERADICATION FOR THE UNITED STATES

As the member nations of the PAHO approached successful conclusion of their programs for *Ae. aegypti* eradication, they became concerned over the threat of reinfestation from areas where the vector is still plentiful. In 1961, therefore, the PAHO Directing Council approved a further resolution, this time recommending that all nations in the Western Hemisphere initiate and complete eradication by 1966. Again, the United States was a signatory to the resolution.

Preparatory to initiating an eradication program for the United States, it was necessary to determine the distribution and density of *Ae. aegypti* and to ascertain the most practical eradication procedures. Accordingly, *Ae. aegypti* surveys were made during 1956 to 1962, and limited control operations were conducted in many international traffic areas. A pilot project at Pensacola, Florida, during 1957 to 1961, demonstrated feasible methods of eradication.

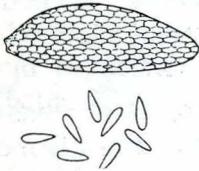
In late 1963, Congress provided funds to initiate a program of *Ae. aegypti* eradication. Through this program the United States will assure the protection of its citizens from yellow fever and dengue, and at the same time meet its hemispheric obligation.

LIFE HISTORY AND HABITS OF *Aedes Aegypti*

Aedes aegypti breeds almost exclusively in artificial containers in and around the house. Discarded automobile tires, discarded automobile bodies, buckets, jars, tin cans, and flower pots containing water are preferred breeding sites. Occasionally *Ae. aegypti* will be found in treeholes near human habitation.

The female lays her eggs singly in batches of 30 to 50 at intervals of several days, depositing them on the sides of a container just above the water line. After

Egg

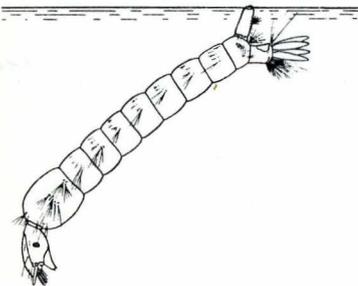


a few days the water has usually evaporated sufficiently to leave the eggs dry and ready to hatch as soon as reflooded. If not flooded, eggs may live up to a year and survive limited periods of freezing weather.

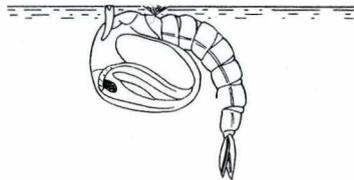
In warm weather, eggs hatch in one day or less after being flooded. Some of the eggs resist hatching during the first flooding but hatch in progressively smaller numbers with each of several subsequent inundations. Some observers have noted that eggs deposited late in the season manifest a greater tendency toward deferred hatching than those deposited when conditions for survival of the larvae are more favorable.

Development of the larvae or 'wiggletails' into pupae requires from 5 to 10 days in the summer and up to many

Larva

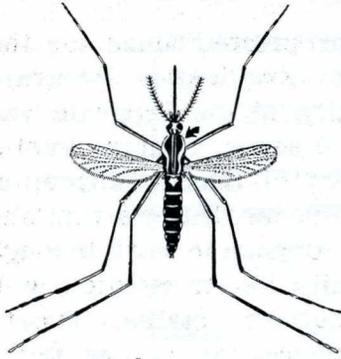


Pupa



weeks in cooler weather. Under normal conditions, the adult emerges from the pupal case in about 2 days. Thus, under the most favorable conditions the entire

Adult



Aedes aegypti

development cycle can be completed in as little as 10 days.

In the tropics *Ae. aegypti* breeds throughout the year, producing a rapid succession of generations; but in the southeastern United States, the time required for the complete life cycle increases during the winter, when the eggs may remain dormant for several weeks or months. The adults are very susceptible to cold, and in the continental United States, except in the extreme southern portion, they can survive the

winters only in sheltered situations.

Adult *Ae. aegypti* are comparatively long-lived. In the laboratory they have survived for 4 months or longer. The males emerge first and remain near the breeding place to mate with the females as they emerge. The females seldom fly far, 75 to 100 yards from the breeding site.

Only female mosquitoes seek blood, and the *Ae. aegypti* females apparently prefer human blood to that of other animals. They make their attack quietly, usually about the ankles, under the coat sleeves, or at the back of the neck. They bite mainly during the daytime, particularly in the morning and late afternoon hours.

ORGANIZATION

In October 1963 Congress appropriated funds for the development of an *Aedes aegypti* Eradication Program in the United States. Responsibility for the Program was assigned to the Communicable Disease Center, Public Health Service, U. S. Department of Health, Education and Welfare. The Communicable Disease Center established an *Aedes aegypti* Eradication Branch to work through the Regional Offices of the Public Health Service with Health Departments in nine southern States, Puerto Rico, and the Virgin Islands where the yellow fever mosquito occurs.

Each State in the *Aedes aegypti* Eradication Program is divided in areas; and the areas, in turn, into zones.

The State Director, a permanent employee of the State department of health, is in charge of the overall program.

The Project Officer is the Chief Federal employee in the State and provides technical direction of program activities.

The Area Supervisor is in charge of program activities within an area.

The Foremen supervise activities of inspectors and spraymen within a zone.

The Inspectors carry out mosquito survey work, spraying operations, and other activities. In a 2-man spraying crew, principal responsibility is vested in the wand-man. In the event larger crews are used, the foreman will designate a crew leader.

U. S. DEPT. HEALTH, EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER

AEDES AEGYPTI
ERADICATION BRANCH

PUBLIC HEALTH SERVICE
REGIONAL OFFICE

STATE DEPARTMENT
OF HEALTH
OFFICE OF STATE
DIRECTOR

PROJECT OFFICER

AREA SUPERVISOR

FOREMAN

INSPECTION AND
ERADICATION CREWS

INSPECTION PROCEDURES

RESPONSIBILITIES AND DUTIES OF AN INSPECTOR

In some State programs a person designated as an 'inspector' may be responsible for making inspections only. However, in most of the programs he will serve a dual role as both inspector and sprayman. In general, his duties and responsibilities, as designated by the State Project Officer and Area Supervisor, will be to:

1. Carefully search premises to locate all real and potential breeding sites,
2. Find and collect *Aedes* larvae,
3. Keep all required forms and records,
4. Serve as a teacher and salesman for the *Ae. Aegypti* Eradication Program,
5. Apply the appropriate control measures as designated by foreman, and
6. Exercise good judgment in the use and care of all Federal, State, and private property.

PUBLIC RELATIONS

The success of the *Ae. aegypti* Eradication Program depends largely on the cooperation which can be obtained from occupants of residences and business establishments. In order to inspect, spray, or carry out other work, the inspector must secure permission to enter onto private property. The granting of permission to enter onto private property will depend on the ability of the inspector to sell himself and the program.

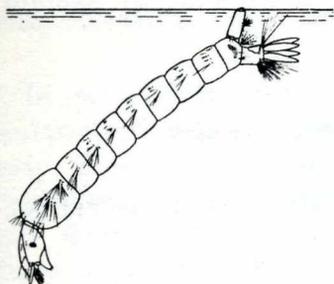
To develop good public relations it is very important that an inspector:

1. Understands the program and is able to explain it to the occupants
2. Presents a neat appearance
3. Is courteous and considerate at all times
4. Performs his duties in such a manner as to reflect credit on the program
5. Takes pride in his work
6. Avoids damaging private property
7. Does not drink alcoholic beverages during working hours
8. Observes local regulations concerning smoking
9. Does not smoke during interviews with occupants
10. Observes local traffic regulations
11. Conducts interviews with occupants out-of-doors whenever possible. Uses discretion when entering houses, and
12. Always enters and leaves premises by the front entrance and sidewalks-never cuts through hedges or flower beds, climbs fences, or destroys any plantings or other items on residential, commercial, or other private or public property.

RECOGNITION OF Aedes LARVAE

There are several species of mosquitoes that breed in the same type of receptacles as *Ae. aegypti*. Some of these mosquitoes are so similar to *Ae. aegypti* that they cannot be separated in the field. For purposes

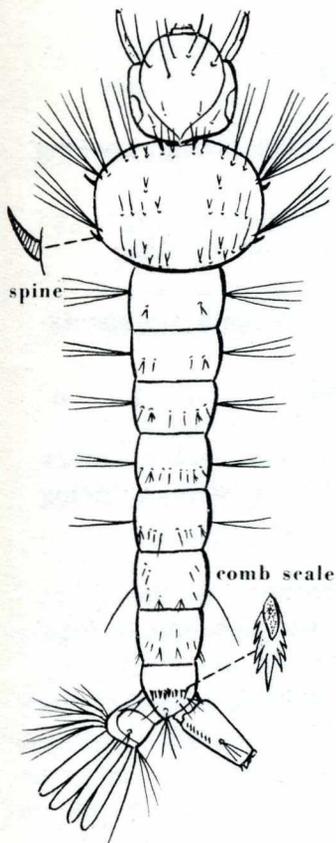
of survey records, all *Aedes* larvae will be considered as *Ae. aegypti* until checked by the area office for identification. The following information will help the inspector separate *Aedes* from others:



Position—the larvae hang ‘head down’.

Movement—the *Aedes* larvae have a characteristic ‘S’ shaped, serpent-like, or ‘figure 8’ movement, which involves all parts of the body.

Air tube—the air tube is dark in color and about twice as long as wide.



Light—larvae react quickly to changes in intensity of light. They are disturbed by the beam of a flashlight or by a shadow and will retreat to, and remain in the darkest part of a container. The removal of the cover from the container will startle larvae, even if the container is not shaken. Because *Aedes* larvae will dive to the bottom of a container when disturbed, they may be overlooked unless the inspector makes a careful search.

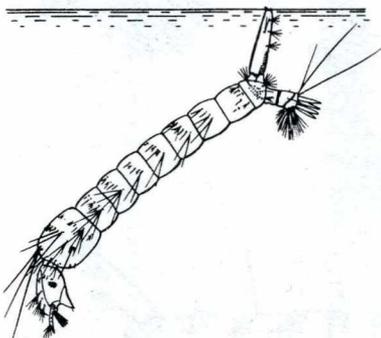
Ae. aegypti can be identified microscopically by the presence of 4 spines at the sides of the thorax and a single row of comb scales, each with a long median spine and prominent lateral denticles.

Drawings showing the names of the principal parts of larval and adult mosquitoes are shown on pages 18, 19, and 26.

RECOGNITION OF OTHER LARVAE

Culex and *Anopheles* are two common groups of mosquito larvae frequently found in association with *Ae. aegypti* and other *Aedes* larvae.

The following information will help the inspector recognize *Culex* and *Anopheles* larvae:



Culex

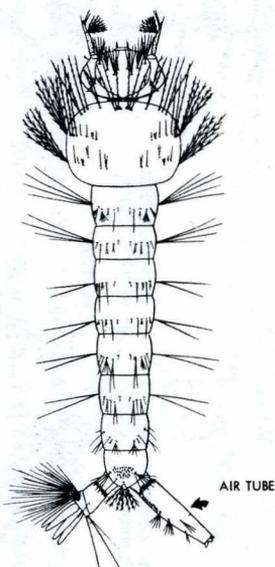
Position-the larvae hang 'head down'.

Movement-*Culex* larvae have a whip-like or figure 'C' movement which propels them rapidly to the bottom of a container.

Air tube- the air tube is long and tapered, being at least 3 times as long as wide.

Light-*Culex* larvae are not very sensitive to changes in light intensity-much less so than *Ae. aegypti*

Timidity-A rather strong disturbance is required to startle *Culex* larvae and cause them to go to the bottom of a container. However, they return fairly soon to the surface.



Anopheles

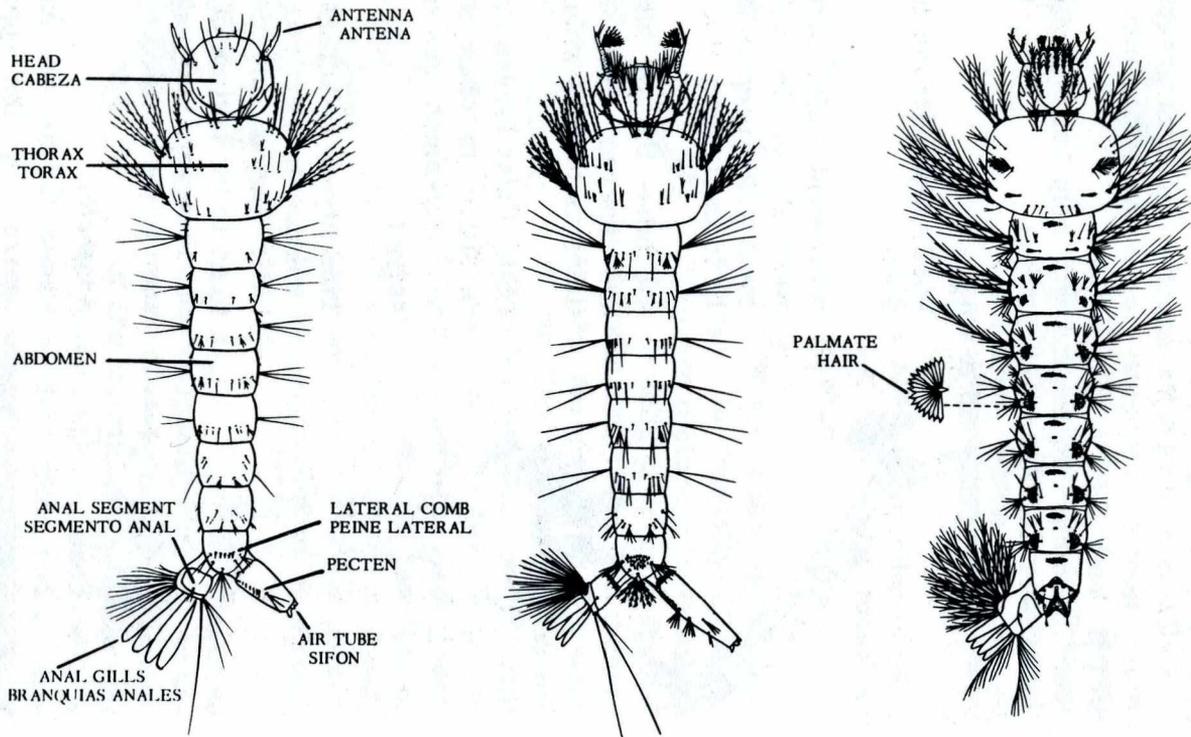
These larvae are easily recognized by the apparent absence of an air tube and by their habit of lying parallel to the surface of the water.

COMPARATIVE CHARACTERISTICS OF LARVAE
 CARACTERISTICAS COMPARATIVAS DE LARVAS

Aedes aegypti

Culex

Anopheles

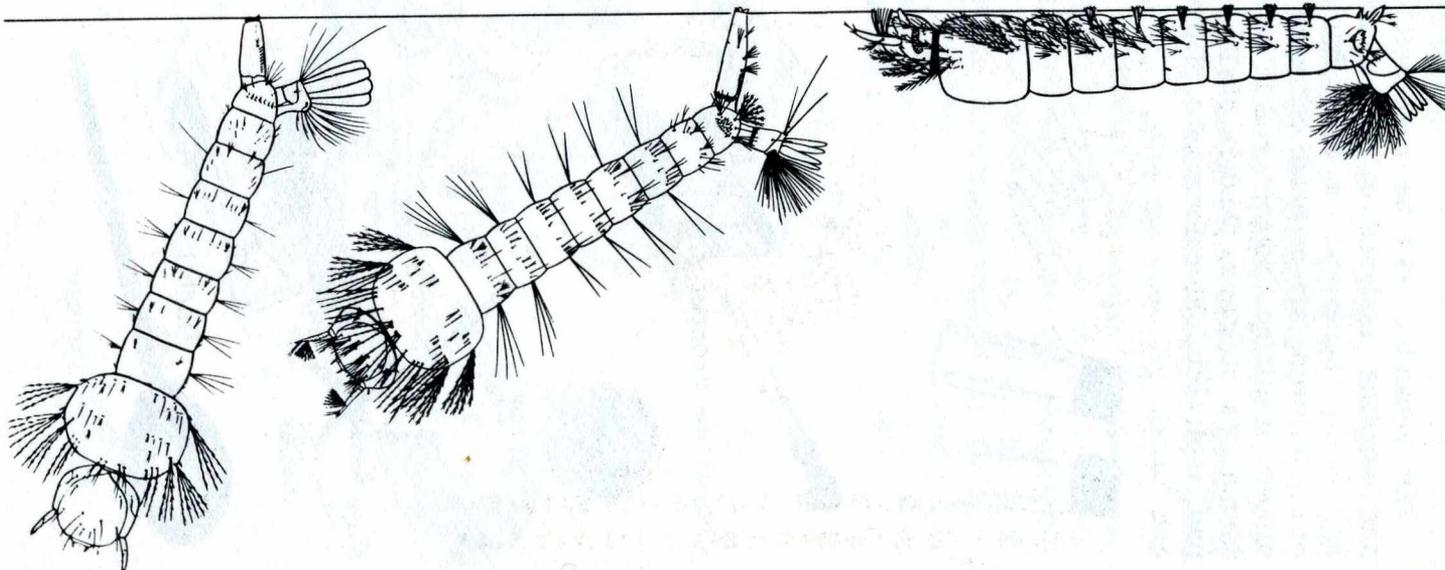


COMPARISON BETWEEN BREATHING POSITIONS OF LARVAE AT SURFACE OF WATER
 COMPARACION ENTRE LAS POSICIONES DE LAS LARVAS RESPIRANDO EN LA SUPERFICIE DEL AGUA

Aedes aegypti

Culex

Anopheles



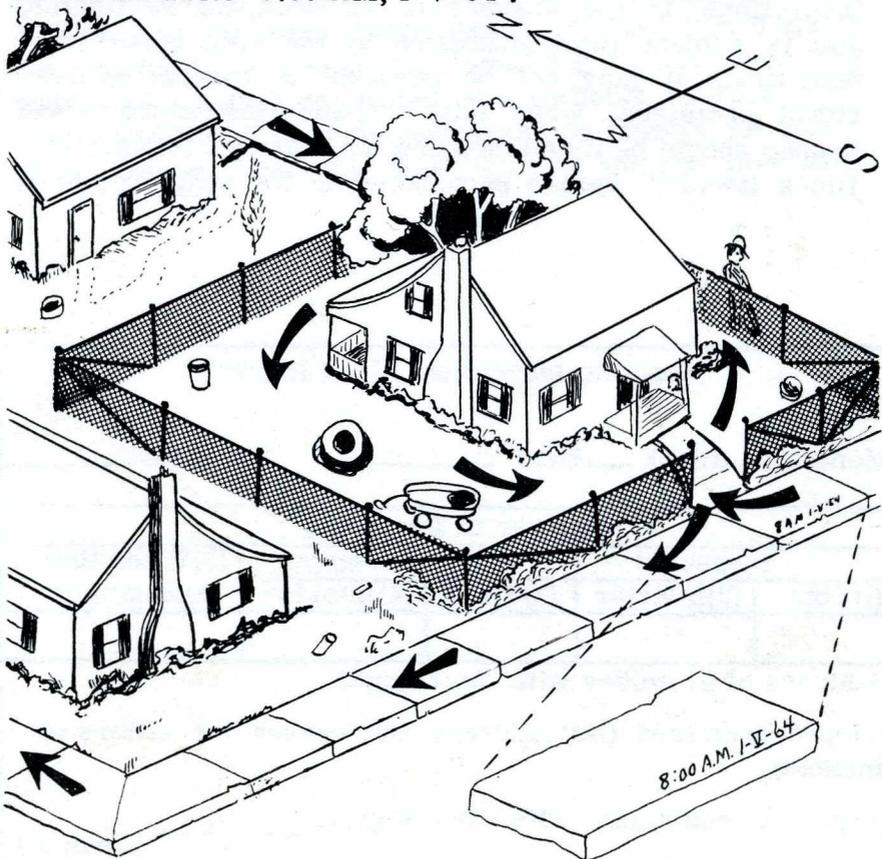
INSPECTOR'S EQUIPMENT AND SUPPLIES

The inspector will be responsible for all equipment and supplies assigned to him. Before each day's work he should check and be sure that sufficient materials of the following are on hand: carrying case, 2-dram vials, dipper, medicine dropper, vial labels, mirror, flashlight, forms, tea strainer, pencils, chalk, battery syringe, note pad, aspirator, chloroform tube, pillboxes with cellucotton, and forceps.



INSPECTION OF PREMISES

When beginning the inspection of a block, the inspector starts with the premises at the southeast corner and works around the block in a clockwise direction inspecting all premises as he proceeds. The time of beginning work in each block is recorded, writing it with chalk where it can be seen easily from the street--for example, on a utility pole, the sidewalk, a smooth-barked tree, or the curbstone. The inspector should use discretion about where he writes, so as not to deface property. Whenever dates are involved, the days of the month should be written in Arabic numerals (1, 2, 3, 4, etc.) and the months in Roman numerals (I for January, II for February, III for March, etc.). For instance, if a man begins his inspection at 8:00 A.M. on May 1, 1964, he should write '8:00 AM, I-V-64'.



How To Inspect A Premises

Before entering onto a premises, the inspector should record the zone, the block, the date, and his name on Form 2.1, 'Mosquito Inspection-Block Record'. He should identify himself to the owner or occupant of the premises. He should be polite but persuasive. The success of the *Aedes aegypti* Eradication Program depends on the cooperation of the public permitting inspection of private property. Insofar as possible, inspections should be made systematically. Because of the variety of ways that houses or other buildings may be placed on a lot, only general rules can be given. When possible, the inspector should start just to the right of the entrance and proceed around the premises in a counter-clockwise direction. Special attention should be given to containers that may be hidden under rubble or vegetation or in outbuildings.

The procedure for entering premises and making inspections in the absence of an occupant is flexible and is subject to modification by the area supervisor. Sometimes it may not be possible to inspect an individual premises. When this happens, the address and reason should be listed on Form 2.1, 'Mosquito Inspection-Block Record', before proceeding to the next premises.

Mosquito Inspection-Block Record				
Zone _____		Block _____		Date _____ Inspector _____
Number of Premises				
Inspected		With <i>Ae. aegypti</i>		(5) With Other Mosquitoes
(1) Total	(2) Interior	(3) Total	(4) Interior	
Address of premises with <i>Ae. aegypti</i>				
Closed premises (list address and reason for failure to inspect)				
Type of container with <i>Ae. aegypti</i> _____				

Form 2.1

How To Inspect Containers

Inspection for *Ae. aegypti* involves a careful search of premises for the many artificial containers in which they may breed. All containers of water are examined. It is best to proceed slowly and carefully in searching for larvae, as disturbing the water or casting shadows will cause the larvae to dive to the bottom, and possibly remain out of sight. When a container with water is found, observe the surface of the water, looking for mosquito larvae which may be resting quietly or moving in their characteristic fashion. If no larvae or pupae are seen at the surface, tap the container gently and watch for motion. If no larvae are seen in a large container, make several quick dips beneath the surface of the water towards the sides of the container. Water in small containers may be poured into a dipper where larvae may be seen more easily. Quite often a small tea strainer is useful for removing larvae from the water in containers which are difficult to look into. When additional light is necessary to inspect for mosquito larvae, use the flashlight or mirror provided.

Collection Of Mosquito Larvae And Pupae

Since *Ae. aegypti* cannot be specifically identified in the field from other *Aedes* larvae, a sample of larvae encountered should be collected. Initially a new inspector is required to collect from each premises mosquito larvae and pupae from containers found breeding, until he can differentiate between *Aedes* larvae and larvae of other mosquitoes such as *Culex* and *Anopheles*. When the inspector demonstrates his ability to distinguish *Aedes* from other mosquitoes, the foreman will authorize him to collect only *Aedes* Larvae. Collect mosquito larvae by removing them directly from the breeding site with a wide-mouth medicine dropper or dip them from the container and transfer them from the dipper to a vial by means of a medicine dropper. The battery syringe supplied to each inspector is useful in collecting larvae from water in tires and other containers into which the dipper cannot be inserted. In most cases larvae will be collected and placed in vials containing only water. In certain instances, however, such as Friday collections that cannot be examined before Monday, it may be desirable to collect them in 95 percent alcohol. This may be done by removing the water and debris from the collection bottle with a medicine dropper and then adding 95 percent alcohol.

Every collection must be labeled immediately. Using a soft lead pencil, (never a pen) fill in the required information on the labels provided. Insert the label in the vial and tighten the screw cap. Record the address, or if not available, a descriptive location, of premises on Form 2.1 'Mosquito Inspection-Block Record'.

Date _____
Zone _____ Block _____
Address _____
Inspector _____

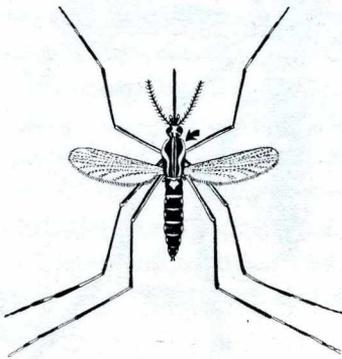
Collection And Preservation Of Adults

Under certain circumstances, the collection of adult mosquitoes will be of value. The breeding of *Ae. aegypti* in hidden containers may be difficult to locate. The presence of adults indicates breeding in the immediate vicinity.

When all of the aquatic forms of *Ae. aegypti* have emerged, adults may be found resting near the container or on the water. When this situation prevails, the collection and identification of adult specimens will afford the only means of verifying the presence of the species. The collection of adults is especially important when the *Ae. aegypti* index in an area is low.

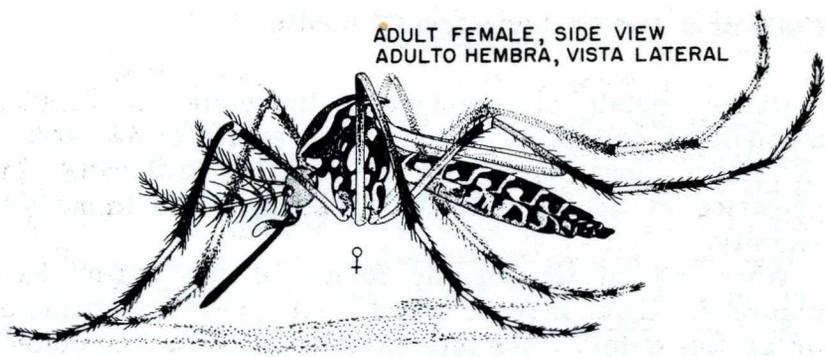
The inspector must be familiar with the coloration and markings of adult *Ae. aegypti* to avoid confusing them with other mosquitoes. Several features make

the adult *Ae. aegypti* one of the easiest mosquitoes to identify. It is a rather small, black mosquito with white bands on the legs (tarsi) and a distinctive white lyre-shaped marking on the back (thorax). Specimens of *Ae. aegypti* in poor condition can be identified by the silvery-colored scales on the palps and clypeus (base of the proboscis). The abdomen is pointed rather than blunt as in *Culex*. Male mosquitoes can be easily differentiated from the females because the antennae of males are much bushier than those of the females, as illustrated on page 26.



Aedes aegypti

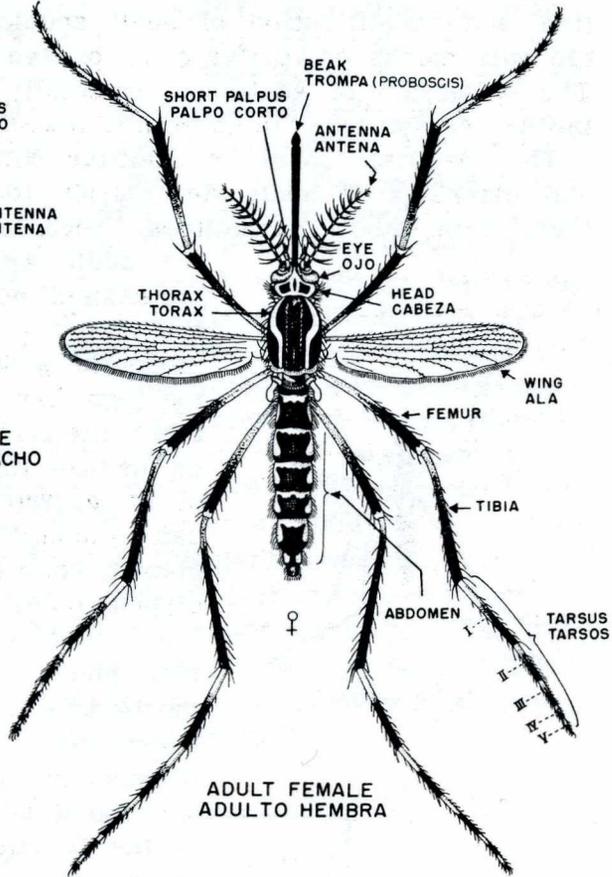
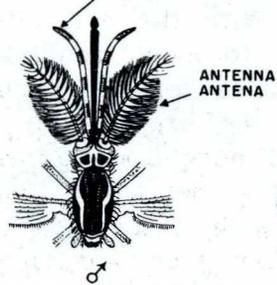
ADULT FEMALE, SIDE VIEW
ADULTO HEMBRA, VISTA LATERAL



LONG PALPUS
PALPO LARGO

ANTENNA
ANTENA

HEAD OF ADULT MALE
CABEZA DEL ADULTO MACHO



BEAK
TROMPA (PROBOSCIS)

SHORT PALPUS
PALPO CORTO

ANTENNA
ANTENA

EYE
OJO

HEAD
CABEZA

THORAX
TORAX

WING
ALA

FEMUR

TIBIA

ABDOMEN

TARSUS
TARSOS

ADULT FEMALE
ADULTO HEMBRA

Adult mosquitoes may be collected with an aspirator or a chloroform tube. If they are collected with the aspirator, they should be blown into a chloroform killing tube. The killed specimens are placed in pillboxes between layers of cellucotton or tissue (facial or toilet tissue, or lens paper). Specimens should be handled with extreme care as they are easily damaged making identification difficult. Each pillbox must be labeled with pencil, recording the date, zone, block, street address, and inspector's initials.



Indoor Inspections

When, upon the direction of the foreman, it is necessary to make an inspection of the interior of homes or commercial establishments, the inspector should first identify himself, explain clearly the purpose for the inspection, and obtain permission to enter. He should use discretion in entering homes. In making certain indoor inspections, it may be desirable for 2 inspectors to work together.

Such indoor inspections should be made methodically, always in the presence of an adult occupant, checking carefully for all possible breeding receptacles.

When mosquito larvae are found, they should be pointed out to the occupant and appropriate eradication measures applied.

Informing The Occupant of Inspection Results

The special mosquito inspection report (page 28) should be used to solicit aid of the householder in eliminating sources of *Ae. aegypti* production.

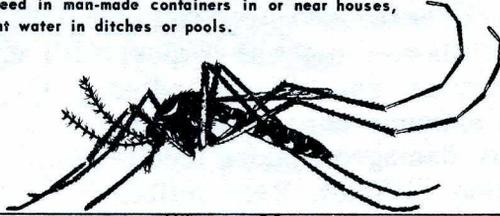
The inspector should complete this report, indicating any improvements needed to eliminate potential or actual *Ae. aegypti* breeding sites on the premises, and give it to the householder. If an adult occupant is not present, the form should be left in a conspicuous, protected or sheltered place. This form should not be placed in the mail box.

MOSQUITO INSPECTION REPORT (FORM 2.2)

REPORTING RECORD (FORM 2.2)

HELP STOP MOSQUITO BREEDING

Your community and neighbors need your help in eradicating the mosquitoes that may carry yellow fever or dengue. These mosquitoes breed in man-made containers in or near houses, not in stagnant water in ditches or pools.



Dump Standing Water to Kill Eggs, Larvae (Wrigglers), and Pupae (Tumblers).



Eliminate All Standing Water in Which They Can Breed.



Wash and Refill Animal Drinking Pans Daily



Grow House Plants in Earth, Sand, or Vermiculite . . . Not Water.

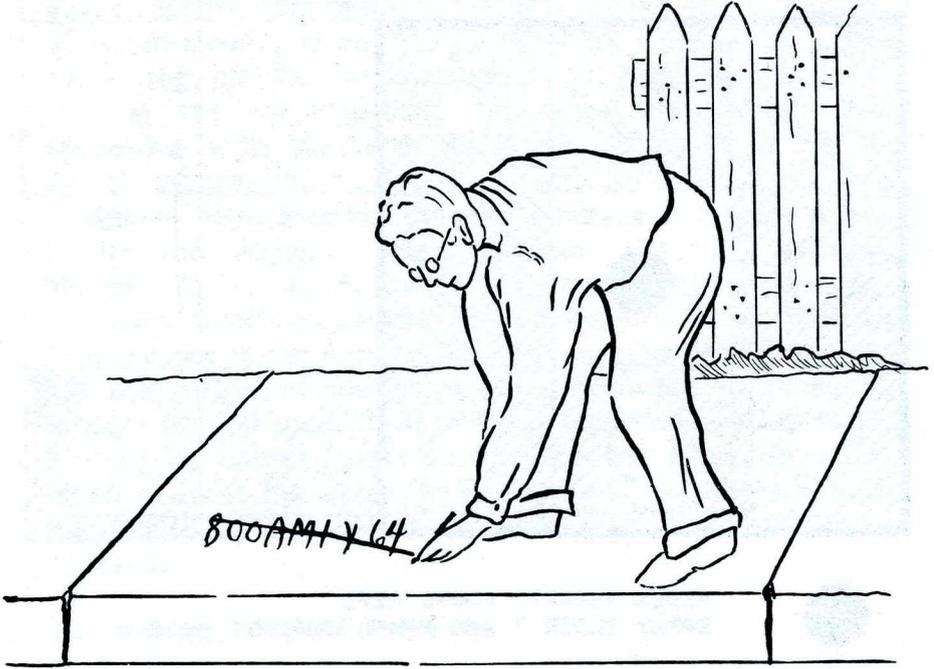
CORRECTIONS NEEDED

- None. You have the thanks of your community and neighbors.
- Clean up and dispose of cans, bottles, old tires, or other containers which may hold water.

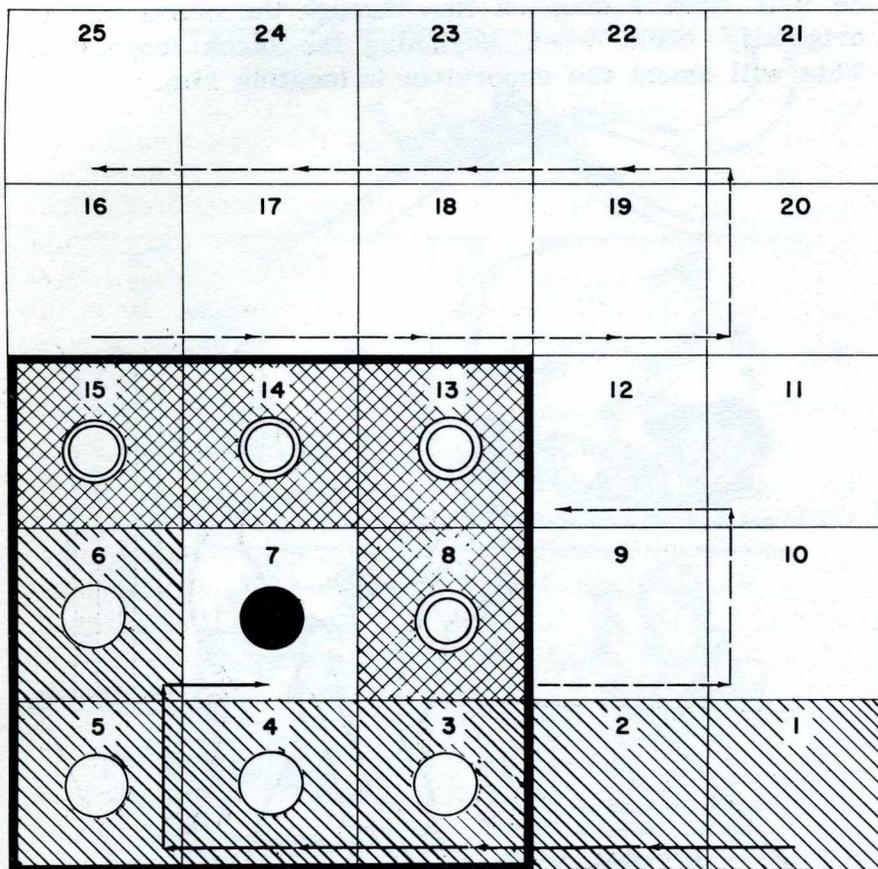
For additional information call _____

COMPLETION OF BLOCK SURVEY

When an inspector has completed the survey of a block, he will draw a diagonal line through the marks that he originally made when beginning the block inspection. This will assist the supervisor in locating him.



SURVEY PROCEDURES



**AEDES AEGYPTI FOUND HERE
 SPRAY BLOCK 7 AND EIGHT ADJACENT BLOCKS**



BLOCKS NOT INSPECTED (SPRAY)



**BLOCKS INSPECTED
 NO AEDES AEGYPTI FOUND HERE**



TOTAL AREA TO BE SPRAYED



ROUTE OF INSPECTION

SURVEYS

INSPECTION OF BLOCKS

The inspector will search all premises within a block until he finds *Aedes* larvae or until he is reasonably certain that none exists. When the inspector finds *Aedes* larvae he will record the required information on the Mosquito Inspection-Block Record (Form 2.1). The inspector will not inspect any more of the uninspected blocks surrounding the one in which *Aedes* larvae were found.

For example, in the diagram of the numbered blocks (left) the inspector checks blocks 1-6 and finds no *Aedes* larvae. In block 7, *Aedes* larvae are collected. The remainder, if any, of block 7 is not inspected. The remaining blocks surrounding block 7 (blocks 8, 13, 14 and 15) are not inspected. The inspector continues his surveying with blocks 9, 10, 11, 12, 16, 17, 18, 19, 20, 21, 22, 23, 24, and 25.

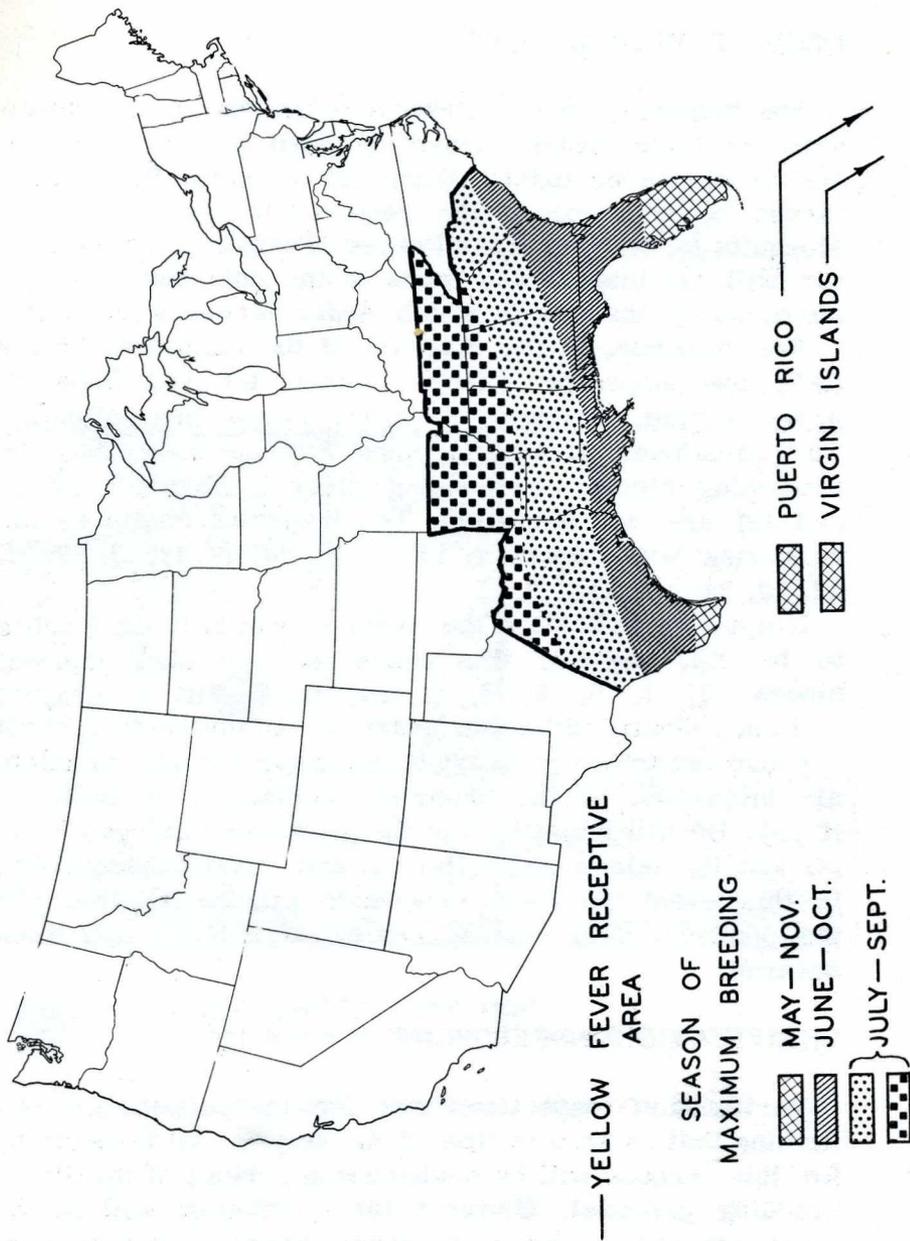
If upon identification the *Aedes* larvae in block 7 prove to be *Ae. aegypti*, this block and the eight adjacent blocks, 3, 4, 5, 6, 8, 13, 14, and 15 will be sprayed.

If upon identification the *Aedes* larvae collected in block 7 prove not to be *Ae. aegypti*, the inspector will complete his inspection of the premises remaining in block 7, if any. He will inspect all of the premises in blocks 8, 13, 14, and 15, unless *Aedes* larvae are found subsequently. In this event the above procedure will be followed with the positive block as the center of a block area to be sprayed.

VERIFICATION INSPECTIONS

Verification inspections are for the purpose of confirming that an area is free of *Ae. aegypti*. All inspections for this purpose will be made during periods of maximum breeding potential. Criteria for eradication will be the same for urban and rural areas. Seasons of maximum breeding are defined as May through November for

YELLOW FEVER RECEPTIVE AREA SHOWING PERIODS OF
MAXIMUM BREEDING OF AEDES AEGYPTI



Operational Zone A, June through October for Zone B, and July through September for Zones C and D (see map opposite).

Verification surveys require a minimum of three negative successive inspections of an area at about one-year intervals. Following the third negative inspection an area is designated as free of the *Ae. aegypti*.

The first verification inspection requires a search of all premises in an area. Where all premises are inspected and are negative for *Ae. aegypti* during the last comprehensive survey, this survey will be considered as the first verification inspection. The second verification inspection, made approximately one year later, consists of checking alternate premises in a given area. The third (last) verification inspection, made a year following the second verification, consists of inspecting premises skipped during the second verification.

If any time during the verification inspections, *Ae. aegypti* are recovered, encompassment spraying is reinstated. Comprehensive surveys then will be made until all premises are negative. The last comprehensive survey that is negative for all premises is again considered the first verification inspection. The second and third verification inspections will follow.

ERADICATION METHODS

POWER SPRAYING

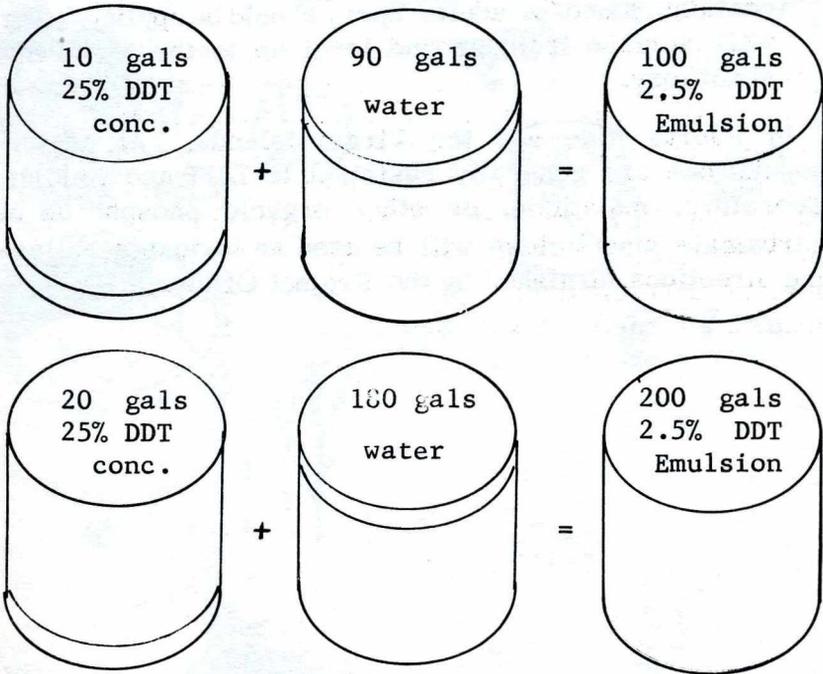
Regulations of State and local departments of health concerning entry into private property will be observed. Ordinarily, permission to enter a specific premises must be obtained from the occupant. It can not be over-emphasized that the success of the eradication program rests directly upon cooperation of the public.

A spray team will normally be composed of two men, one man who directs the spray nozzle (wand-man) and one who manages the hose (hose-man). Ordinarily the wand-man will drive the spray truck and be responsible for the crew. The hose-man will handle the hose in such a manner as to enable the wand-man to proceed with maximum speed and efficiency. In cities with alleys it may be advantageous to utilize four-man teams and treat premises on both sides of the alley simultaneously. Under certain circumstances it may be advantageous to use a fifth man to drive the spray truck.

In continental United States the spray formulation used by the spray team will be 2.5 percent DDT emulsion. This will ordinarily be prepared from a 25 percent emulsifiable concentrate at the proportion of 10 gallons of concentrate to 90 gallons of water to make 100 gallons of finished spray, or 20 gallons of concentrate and 180 gallons of water to make 200 gallons of 2.5 percent DDT emulsion spray. Where resistance to DDT occurs, alternate insecticides will be used.

The primary objective of the spray program is the eradication of *Ae. aegypti* larvae and adults through treatment of breeding places and adult resting areas. Although conditions in different areas may necessitate certain modifications in established procedures, the following guidelines for spraying operations are outlined. It should be clearly understood that these are guidelines only and modifications to improve and more efficiently and effectively accomplish eradication of *Ae. aegypti* from the specific area are not only a prerogative of the area supervisor, but more specifically a duty and responsibility.

Ratios of Water
and 25-percent Emulsion Concentrate
to Produce Finished Formulation



Spray should be applied to:

1. The inside and outside of old tires;
2. All discarded buckets, jars, tin cans, flower pots, or other containers holding water or that could hold water and allow *Ae. aegypti* to breed;
3. Trash dumps on premises, even though the presence of breeding containers is not obvious;
4. The interior and exterior of storage sheds;
5. The wall surface of unscreened back porches;
6. The underside of houses unless they are underpinned and enclosed;
7. Wooden fences associated with weeds and other vegetation should be sprayed.
8. The outside surfaces of residences in those situations where dense growths of shrubbery may harbor breeding containers and/or adults. Spray should be applied to the wall surface from ground level up to the top of the shrubbery.

In Puerto Rico and the Virgin Islands, *Ae. aegypti* populations are generally resistant to DDT and dieldrin. Therefore, malathion, or other organic phosphorus or carbamate insecticides will be used as toxicants, following directions furnished by the Project Officer.



Spray should NOT be applied to:

1. The interior of residences;
2. Open areas, such as well-kept lawns;
3. Flowers and shrubs with tender new growth. Spraying of these items may cause burning from the spray solvent; and
4. Fences except as designated in Item 7 above.

Each two-man crew will have 250 ft. of 3/8" high-pressure spray hose, and an orchard-type spray gun adjustable from a wide-angle cone spray to a solid stream. The wide-angle cone spray is used for most routine work, the solid stream is useful in spraying treeholes, mounds of tires, containers, and undersides of houses. Recommended spraying pressure is 250 pounds per square inch at the pump.

The wand-man should plan the most efficient movement of hose in order to obtain complete coverage of the premises, to allow the hose-man to keep the hose free of obstacles such as flowers, shrubs, trees, and steps.

Never leave a premises until all potential breeding places have been sprayed. Take the time to be certain. No mosquito breeding site or resting places for adult mosquitoes should be missed.

MAINTENANCE OF EQUIPMENT

Power Equipment

Each spray crew will be responsible for the proper care and maintenance of the power spray unit. Manufacturer's instruction on lubrication and operation of power spray unit must be followed carefully each day the sprayer is used. Pumps must be drained at the conclusion of the operations season to prevent winter damage. Recommendations of manufacturer must be followed to prepare equipment for storage. Spray guns will never be placed upon the ground. Defective parts will be replaced as needed.

The hose must be handled with care to avoid kinking it, running over it with the vehicle, cutting it with sharp objects, or otherwise damaging it. Drain and flush hoses with water each Friday, or at any other time when the spray unit will not be used for several days.

Hand Spray Equipment

Hand spray units present a continuing maintenance problem. Several basic rules should be followed in the care of a hand sprayer.

1. Handle with care;
2. Keep it clean;
3. At the close of each work-day rinse it and spray water through the hose, valve, and nozzle;
4. Do not let water freeze in it; and
5. Replace gaskets, nozzle tips, and other parts as necessary.

SPRAYING PRECAUTIONS

With proper formulation and application, insecticides may be used without harm to human beings, household pets, birds and other wildlife. Since fish are especially susceptible to most insecticides, care should be taken when spraying in the immediate vicinity of fish ponds. Drift of the spray must be considered to avoid accidental contamination of fish ponds. Tender vegetation and shrubbery with new growth should not be sprayed. Do not spray vegetable gardens or fruit-bearing trees. Avoid spraying near beehives, and places where fish-bait such as worms and crickets are raised. Avoid spraying automobiles and other objects with enameled or varnished surfaces.

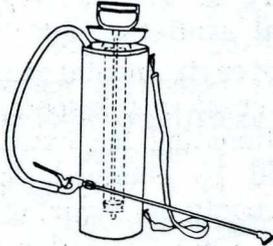
Persons preparing finished spray from insecticide concentrates should always wear rubber gloves for their own protection and avoid spilling the material on the skin or getting it into the eyes. If the skin is contaminated when insecticide is accidentally spilled, the contaminated areas should be promptly washed with soap and water. If the eyes are contaminated flush them with clean water and obtain first aid treatment. Personnel will not smoke while handling the concentrates.

ENVIRONMENTAL SANITATION

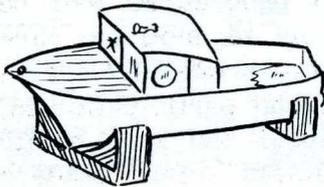
Mosquito source reduction, the elimination of *Aedes aegypti* breeding sites by improving premises sanitation, conducting clean-up campaigns and related sanitation activities, will be an integral part of the *Ae. aegypti* eradication program. Environmental sanitation activities will include comprehensive surveys of environmental sanitation conditions in each block concurrent with inspections for *Ae. aegypti*. In addition to delineating the extent of the *Ae. aegypti* problem, data will be obtained on all socio-economic and environmental conditions favoring the production of domestic mosquitoes. The information will be utilized to develop an effective mosquito source reduction program in collaboration with local departments of health. Effective methods and procedures will be applied to obtain public support and to motivate participation of individual citizens in comprehensive eradication programs. Endorsement of, and participation in, all phases of the program by local and state health representatives, other public officials, civic leaders and residents will be encouraged in each community. Operational procedures, together with educational and promotional materials for the environmental aspects, are contained in another manual.

OTHER METHODS

While the success of the *Ae. aegypti* Eradication Program depends principally on the use of insecticides dispensed by power equipment, other measures will be used as needed. Example of supplementary measures are:



1. Use of compressed air hand sprayers for residual spraying of places inaccessible to power spray units.

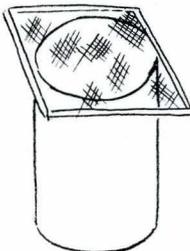


2. Destruction of larvae by elimination of breeding places during inspections or spray operations;

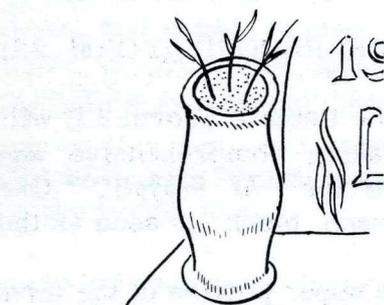
3. Residual larviciding of water in fire barrels and boats that cannot be drained;



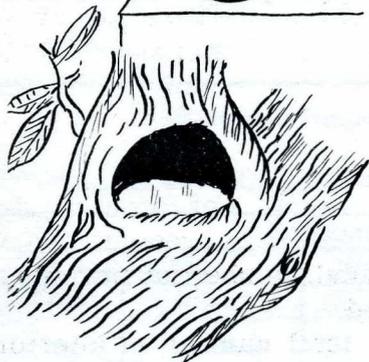
4. Stocking ornamental ponds with top-feeding minnows or spraying them with an insecticide of low toxicity to fish and aquatic plants;



5. Treatment of drinking water in barrels and cisterns, when necessary, with a larvicide of low mammalian toxicity. Encouragement of occupants to install screens on containers which cannot be eliminated;



- Promotion of the use of artificial flowers in sand-filled containers in cemeteries. When cut flowers are used, vases and urns should be filled with sand which will hold moisture but not afford a suitable site for mosquito breeding;



- Source reduction measures such as filling treeholes with sand, tar, concrete or other materials to prevent mosquito breeding; and



- Information programs to secure public support in carrying out source reduction measures. This should also include information such as the necessity of flushing out bird baths, or replacing water in flower vases with house plants, on a daily or twice weekly bases.

REPORTS AND RECORDS

MOSQUITO INSPECTION-BLOCK RECORD (FORM 2.1)

The 'Mosquito Inspection-Block Record' (Form 2.1) will be used by the inspectors making comprehensive and verification inspection surveys for *Ae. aegypti*. One form will be filled out for each block as soon as the inspection is completed.

Complete the headings on the upper portion of the form which include:

zone, block, date, and inspector.

NUMBER OF PREMISES

Inspected

Total (Column 1): insert total number of premises inspected.

Interior (Column 2): insert total number of interior inspections made.

With *Ae. aegypti*

*Total (Column 3): insert total number of premises with *Ae. aegypti* (larvae or adults). If both *Ae. aegypti* and other mosquitoes are found the premises is recorded as infested with *Ae. aegypti*.

*Interior (Column 4): insert total number of interior inspections positive for *Ae. aegypti*.

With other mosquitoes (Column 5): insert total number of premises with other mosquitoes (larvae, rarely adults, without species identification).

*Normally only one positive inspection for *Ae. aegypti* will be recorded, as inspections are stopped when the species is found and encompassment spraying is instituted.

ADDRESS OF PREMISES WITH AEDES AEGYPTI: record street and house number of positive premises. In rural areas record route and box number; if none, describe in relation to a recognizable geographic point.

CLOSED PREMISES: information required is described on the report form.

Mosquito Inspection-Block Record				
Zone _____ Block _____ Date _____ Inspector _____				
Number of Premises				
Inspected		With Ae. aegypti		(5 With Other Mosquitoes
(1) Total	(2) Interior	(3) Total	(4) Interior	
Address of premises with Ae. aegypti				
Closed premises (list address and reason for failure to inspect)				
Type of container with Ae. aegypti _____				
				Form 2.1

MOSQUITO INSPECTION REPORT (FORM 2.2)

The 'Mosquito Inspection Report' (Form 2.2) is designed to inform the house-holder of the findings of the inspection. The report, which is intended for use during the source reduction phase of the program, will be completed as each premises is inspected.

The first paragraph of the Form and the four pictures explain the purpose of the visit and suggest measures that the occupant can take to prevent mosquito breeding on his premises. The house-holder's attention should be directed to these measures when he is given the report.

CORRECTIONS NEEDED:

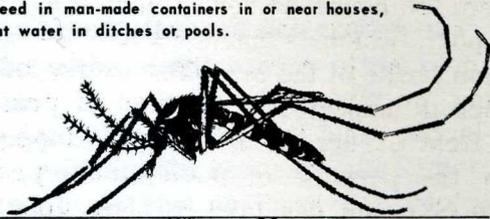
1. If no breeding or potential breeding receptacles are found, item 1 will be checked.
2. If breeding or potential breeding places are found, such as cans, bottles, old tires, etc.. item 2 will be checked.

ADDRESSES:

The address of the premises inspected will be written on the two blank lines near the bottom of the page. The address and telephone number of the local organization conducting the *Aedes aegypti* Eradication Program can be stamped on the last line.

HELP STOP MOSQUITO BREEDING

Your community and neighbors need your help in eradicating the mosquitoes that may carry yellow fever or dengue. These mosquitoes breed in man-made containers in or near houses, not in stagnant water in ditches or pools.



Dump Standing Water to Kill Eggs, Larvae (Wrigglers), and Pupae (Tumblers).



Eliminate All Standing Water in Which They Can Breed.



Wash and Refill Animal Drinking Pans Daily



Grow House Plants in Earth, Sand, or Vermiculite . . . Not Water.

CORRECTIONS NEEDED

- None. You have the thanks of your community and neighbors.
- Clean up and dispose of cans, bottles, old tires, or other containers which may hold water.

For additional information call _____

BLOCK SPRAYING RECORD (FORM 2.3)

The 'Block Spraying Record' (Form 2.3) will be used by the wand-man to record the number of man hours spent spraying premises, the number of premises sprayed in each block, and the gallons of insecticide used. Information is also required for closed premises.

Complete the headings on the upper portion of the form which include: zone, block, date, and crew chief.

Man hours (Column 1): record the number of man hours spent spraying premises in this block. Prorate the time spent in preparing equipment and in travel among blocks sprayed. Time lost because of rain or spent on other types of activity is not so prorated.

Number of premises sprayed (Column 2): record the number of premises sprayed in this block.

Gallons of insecticide used (Column 3): record the number of gallons of insecticide used in this block. The gallons used will be determined by measuring the insecticide in the tank before and after spraying each block. Use a dip stick for measuring.

Closed premises: information required is described on the report form.

Block Spraying Record		
Zone _____ Block _____ Date _____ Crew Chief _____		
(1) Man Hours	No. of (2) Premises Sprayed	Gallons of (3) Insecticide Used
Closed premises (list address and reason for failure to spray)		
Form 2.3		

GLOSSARY

AEDES AEGYPTI-The mosquito vector of yellow fever and dengue in the continental United States, Puerto Rico, and the Virgin Islands.

AEDES AEGYPTI INDEX-The ratio of premises infested with *Ae. aegypti* to the total number of premises inspected. The formula for determining the Index is:

$$\frac{\text{Number of premises infested with } Aedes \text{ aegypti} \times 100}{\text{Number of premises inspected}} = Aedes \text{ aegypti Index}$$

AREA-An area constitutes an individual program within one or more municipalities, and may include one or more counties.

AREA SUPERVISORS-Personnel who direct activities of the *Ae. aegypti* Eradication Program within one or more municipalities (areas).

BLOCK-A division of a municipality easily defined by such geographic boundaries as streets, railroads and rivers, and which includes one or more premises. A vacant block will be considered a single premises.

CLOSED PREMISES-Premises that project personnel cannot enter for various reasons, such as refusal of permission for entry, premises locked, or presence of a vicious dog.

COMPREHENSIVE SURVEY-Inspection of all premises in a given area.

DENGUE-A disease caused by the dengue virus and transmitted by *Ae. aegypti* and other mosquitoes. Ranges in severity from mild, inapparent infections to severe illness with headache, fever, and considerable pain in muscles, joints, and bones. Seldom is fatal but may cause prolonged disability.

ENCEPHALITIS-Inflammation of the brain; often infection with mosquito-borne arboviruses that cause mild inapparent infections, illness of varying degree, fever, incoordination, or even death.

ENCOMPASSMENT SPRAYING-Treatment of isolated infestations in which the adjacent blocks are treated with residual insecticide prior to treatment of the infested block.

ERADICATION-Extermination of *Ae. aegypti* from the continental United States, Puerto Rico, and the American Virgin Islands.

FOCUS-(plural foci) A site comprising one or more closely associated receptacles in which *Ae. aegypti* is produced.

FOREMEN-Personnel who supervise inspectors.

INSECTICIDE-A chemical used to kill insects.

INSPECTORS-Personnel who search for mosquitoes, apply insecticides, perform source reduction work, and engage in other activities as directed by the foremen.

INTERIOR INSPECTION-A search for *Ae. aegypti* within a structure such as a home, office building or warehouse.

LARVICIDE-Any material used to kill the larval stage of insects; or insecticide treatment of containers capable of supporting, or actually containing, mosquito larvae.

PREMISES-Any area or structure, regardless of use, having an independent entrance and a specific boundary, or bearing a single address. A single premises may be a vacant lot, a single family dwelling (including out-buildings), a hotel, a store, a church, a warehouse, or an apartment building with a single main entrance doorway. A duplex with 2 front doors is considered to be 2 premises. In a large building with a number of stores, each store with a separate entrance is considered to be a separate premises.

PREMISES SPRAYING-The residual and larvicidal treatment of mosquito breeding and resting sites out-of-doors on a premises.

PROGRAM DIRECTOR-A permanent employee of the State department of Health, in charge of the overall program, responsible for broad policy guidance.

PROJECT OFFICER-The chief Public Health Service official on the *Ae. aegypti* Eradication Program in the State, responsible for technical direction on the program activities.

RECEPTACLES-Any container suitable for production of *Ae. aegypti*. These can be artificial (man-made) such as discarded automobile tires, paint buckets, jars, tin cans, and cemetery urns, or natural containers such as tree-holes or water-holding plants.

RESIDUAL SPRAY-A deposit of insecticide capable of killing insects for extended periods of time.

VECTOR-A living carrier, usually arthropod or rodent, which transmits disease-causing organisms from infected to uninfected.

VERIFICATION INSPECTIONS-Search made during the period of maximum breeding potential without finding *Ae. aegypti*. Negative inspections made during each of three consecutive years are required before eradication is considered achieved.

YELLOW FEVER-A disease caused by the yellow fever virus that ranges in severity from mild and inapparent infection to serious illness and death. The same virus causes two epidemiological types of disease: the urban type, transmitted by *Ae. aegypti*, and the jungle type, transmitted by wild mosquitoes.

ZONE-An operational subdivision or part of an area.

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