A Method of Abating Salt Marsh Mosquitoes

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The general principles behind effective mosquito abatement are few; yet their adaptations under varying conditions are many. Thus, perhaps, the main principle underlying a thorough control of the Aedes salt marsh mosquitoes is effective drainage, which is an engineering

problem. This probably is the prime consideration in mosquito abatement areas bordering on tidal lands.

This principle, in conjunction with a knowledge of entomology, can be employed in a novel way to abate the marsh species of mosquitoes, as has been demonstrated in the marsh lands of Solano County, California through the practice of re-flooding large marsh areas during the breeding or hatching, then draining off these flooded areas when the larvae have reached the pupae stage.(1) Effective engineering work through developed drainage facilities makes it possible to destroy that portion of the mosquito eggs or "seed" that has hatched into larvae during the flooding operation--by quickly draining them into tidal waters. In this manner mosquito breeding on large areas of salt marshes can be practically eliminated without the transportation and distribution of large quantities of mosquito oil over marsh mud, which often presents formidable difficulties.

The Matadero Mosquito Abatement District in Santa Clara County, California has developed, in 1934 and succeeding years, a phase of abatement of the salt marsh types of mosquitoes that is similar to the method used in Solano County, excepting that once the larvae have developed in the flooded field, they are killed by oiling and the water is drained off.

A further similarity of the two methods is found through the hatching of the "seed" over a dyked marsh area through trapped waters, each method bringing the available "hatch" to the surface of the existing water level throughout the entire watered expanse. At this point, however, the divergence between the two methods begins to appear. Bringing the available "hatch" to the surface is incidental in the method employed on the Solano marshes, because the larvae so hatched are des-

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(1) F. W. Rush, "Re-flooding and Re-draining Salt Marshes for Mosquito Control, "Pro. 9th Ann. Conf. Mosq. Abt. Officials in Calif., 1938, pp. 60-62.

troyed by quickly and effectively draining them into tidal waters; it is vital in the method followed by the Matadero District, because throughout the entire dyked area the "hatch" is raised up to a point or level of vulnerability. If this level is a boating level, the "hatch" can be destroyed by spreading a single film of light oil from a flat-bottom boat.

The trapped waters are held during a time period required for the complete destruction of the larvae, once the oiling is under way. This time period is short, perhaps not over two or three days, once the oiling is complete. Where a light oil such as Diesel is used, the film disintegrates within a few hours. Although effectively killing the mosquito larvae, the oil does little injury to vegetable, fish, or game life, resulting only in a slightly burned line or fringe on the marsh vegetation after the water is drained off.

Raising the "hatch" to a point or level of vulnerability by means of flooding is the method employed by the Matadero District to abate marsh mosquitoes during the time of spring floods. The hatching of larvae through this partial storage of storm waters is favorable to farmers in the event that the dyked field is used in whole or in part for farm purposes.

Very briefly then, the method of abatement of salt marsh mosquitoes as developed in the Matadero District is a form of flood control whereby the flood waters within a dyked region are held up to a boating level during the oiling period and for a very short time thereafter, thereby enabling the spreading of a light oil by boat over the entire flooded area. This method requires vigilance at the flood gates, for the water level, once attained, should be held as constant as practicable. It must not be allowed to build up too high, in the interests of land owners; yet it should not be allowed to drop low enough so as to interfere with the free movement of the boat.

In efficiency, effectiveness, and economy, this form

of abatement of salt marsh mosquitoes within dyked fields over large areas far exceeds the old orthodox method of oiling by use of the spray can with a crew (or crews) of individual sprayers. It is flood control plus a modified form of oiling. Once the "kill" has been accomplished, the time of water subsidence is unimportant so long as it continues to subside. If it should be allowed to rise again, further hatching might occur.

A further advantage of this method of oiling through flood control over the old orthodox method of spraying with individual sprayers is found in its flexibility. By the newer method, an area confined within dykes and provided with proper gates for efficient flood control can be oiled practically as soon as first instar larvae appear. Over a large marsh area this is of great advantage, for it permits early treatment; and, as before noted, once oiled in this manner, the time for the subsidence of the waters in the flooded area is not of vital importance, and time is thus gained to reach other areas that may be in urgent need of treatment. The difficulties of transporting oil by truck over marsh areas during rainy weather periods (when much of the marsh oiling in California must be done) are also avoided, as the transporting and distributing of oil in drums is possible by boat from landings usually accessible by way of paved roads or graveled approaches.

If a boating depth of water cannot be obtained over the entire dyked area, then perhaps a water level not lower than two or three inches below the surface of the "flats" can be obtained and a spraying of the surface effected through a power sprayer unit set in a flat-bottom boat, using the available sloughs for ways of approach. There can be extended from the power sprayer unit several hundred feet of hose, mounted on a hose reel with a rotating joint, and connected up with the power-driven spray pump.

This was done very effectively by the Matadero District in the Mackay Wireless marsh during the spring of 1942. Due to installation of radio equipment, of antennae, wires, cables, etc., the Company did not permit the water level to rise to the ground level but consented to a level about three inches below the ground surface. The oiling operation was then carried out by extending several hundred feet of hose from the power sprayer unit operating in a flat-bottom boat, which traversed the various sloughs with excellent results as compared with the previous method of oiling this marsh area of approximately two hundred acres by spray can. Not only was less oil and labor required than in former years, but also the "kill" was clean, probably better than 95%. In former years, because of the difficult terrain, one could hardly say the oiling operation of the area approached 70% effectiveness.

In the above operation, although the water level was about three inches below the ground surface, the effect was the same as though it had been above, because the entire "hatch" was raised to a point or level of vulnerability, and in that state was completely eradicated.

Transportation and distribution of oil constitutes the first phase of this method of abatement. During the years of 1941 and 1942, the Matadero District has been constructing suitable loading docks at places on sloughs and borrow ditches nearest paved roadways and graveled approaches, to facilitate the trucking and transfer of oil in 50-gallon drums from oil truck to loading dock, thence by way of boat to points of distribution along the dykes (a drum to approximately every thousand feet of dyke).

The second phase is performed by boat. It consists of spreading the oil by power sprayer on the surface of the water, breaking the oil down into a fine spray which results in a film on the water that is more uniform and more rapidly spread than when the oil is merely "dumped" from the boat. Experience has taught that spraying is the better method.

In addition to establishing loading docks, the Matadero District has obtained through purchase and manufacture the following equipment:

1. HOISTING CRANE, mounted on 1½-ton truck (for launching boat, transferring oil drums from loading dock to boat, etc.)

Material for mast, boom, etc.....	$61.04 (1941)
Manufacturing and fitting to 1940 truck (1½-ton).....	168.00
Labor.....	196.50
Winches (all-steel):	
1 5-ton Ramsey (hand winch) 1937.....	77.25
1 3-ton " (hand winch) 1941.....	56.65
1 Steel pawl (reverse winding for 5-ton winch) manufacture.....	10.82
Blocks:	
4 6" sheave, tar box, wire rope snatch blocks (convertible, used either as snatch or tackle blocks)....	46.87
Cable:	
2 100-ft. lengths of 3/8" plough steel and five 5/8" clevices.....	30.78
	$647.91

2. BOAT ASSEMBLY UNIT, (for transportation and distribution of oil drums from loading dock to dykes, and transportation of power sprayer unit)

1	17' 6" flat bottom boat, beam 8' 6" manufactured of 3-ply wood.....	$ 265.74	
1	Boat Bridle (steel for manuevering boat, material..... $16.04 Manufacture.. $10.00.....	26.04	
1	Tripod and base boards (with leg sockets) and following attachments: a) hose lead; b) gang plank saddle; manufacture (including material)	61.42	
1	Suspension sling for gang plank saddle 12 ft. of 1½" Manilla rope..... Splice..... 1½" Galv. Sister-hooks and wire rope thimble	2.64 1.00 2.34	
2	Chain slings (for maneuvering oil drums) one vertical and one horizontal: Material..... $9.40 Manufacture.. 13.00.....	22.40	
1	Yoke (wood) to enable storage of boat in district garage through vertical lift; material..$3.32 Labor.....19.07....	22.39	
		$403.97	

3. POWER SPRAYER UNIT (set into boat after distribution of oil drums, for oiling operation)

1	#63 Bean Duplex Pump, connected by 1½ h.p. Cusham Husky Engine with overhead suction pipe and hose	$186.50	(1941)

1 500-ft. length of 7/16" Bean Armored Spray Hose with couplings.....$151.50

1 Barrel Frame, Hose Reel Support, Crank, and 2 Hose Reducers..... 35.20

(Bean Spray, San Jose) Tax..... 11.20

1 #1703 Hose Reel with Rotary Joint (Western Fire Equipment Co., S.F.) 38.62

$423.02

4. CHAIN BLOCK

1 1-ton "Lift-a-bout" Cahin Block (Round)..... 87.76 (1940)

5. OUTBOARD MOTORS

1 Model KA-39, 10 h.p..... 123.60 (1941)

1 Model "5-40, 5 h.p..... 78.61 (1942)

$202.21

6. MULTIPLE BLOCKS

a) Double

1 pair double blocks..$9.00

60 ft. of ½" Manilla rope (5 lbs. @ .27... 1.22.. $ 10.22 (1941)

b) Triple

1 pair triple blocks.. 5.52

75 ft. of Seisal 5/8" rope @ .05..... 3.86.. 9.38 (1942)

7. BOAT TRAILER

Steel frame, wheels, and trailer hitch.....66.95

Heavy duty springs..... 8.24

Bolts, etc..... 1.32

Lumber, 120 b.f. @ $75 per M..... 9.00

Manufacturing, welding, re-enforcement, etc.....68.50

Labor.....39.00 $193.01 (1942)

$1,977.40