MOSQUITO CONTROL IN UTAH BY SHORE LINE MODIFICATION[1]

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At the joint meeting of the American and Louisiana Mosquito Control Associations, held in New Orleans in 1968, the authors presented a paper describing shore line modification units installed on a marsh in Utah in an attempt to determine the effects of such modification on mosquito production and other marshland biota (Rees and Winget, 1968). The current paper is a report on the continuation and expansion of this study during 1968.

STUDY AREA: LAKE FRONT GUN, FUR AND RECLAMATION CLUB. In the continuation study on the Lake Front Club, the water on the ten modified and adjacent unmodified units, each 90′ wide by 90′ to 100′ long, was maintained at a fairly constant level throughout the season. The water level was high enough to fill the modified units and cover the adjacent unmodified vegetated units to a depth of 1 to 4 inches, depending on the variation in the elevation of the terrain of these unmodified units. The weekly inspections of all units were conducted in 1968 following the same methods used in 1966 and 1967 *(loc. cit.)*.

In general, the results obtained from this study during 1969 were similar to those obtained during the previous two years. No mosquito larvae were found in any of the modified shore line units. The larvae of *Aedes dorsalis* (Meigen), *Culex tarsalis* Coquillett, and *Culiseta inornata* Williston were present in the flooded saltgrass (*Distichlis stricta* (Torr.) Rybd.) of the unmodified units during 1968 in about the same places and in similar numbers as in the previous two years. The composition of the vegetation in the unmodified units continued predominantly as saltgrass, with a very slight increase in the alkali bulrush, *Scirpus paludosus* A. Nels., and cattails, *Typha latifolia* L.

In the modified units all vegetation was removed in 1966 at the time of construction. In 1968 a small amount of saltgrass appeared in one shallow unit with a water depth of 3 inches. No emergent vegetation appeared in any of the modified units with water depths from 3 to 18 inches. In 1966 no submergent vegetation was present in any of the modified units. In 1967 some submergent plants were scattered in small amounts in all of the modified units. In 1968 the following plants were fairly abundant in most of the units: *Chara* spp.; sago pondweed, *Potamogeton pectinatus* L.; algae, *Cladophora* spp.; and floating duckweed, *Lemna minor* L.

The amount of sediment deposited on the bottom of the modified units in 4-month periods during 1967 and 1968 varied from 0.5 to 1.5 inches depending on the location of the measuring gauge in the unit in relation to the source of water supply.

The higher landward sides of the modified units were observed to be favorite resting and loafing areas for ducks, geese and coots. The adjacent unmodified units were used extensively by these waterfowl for feeding, nesting, brood rearing, resting and cover. The modified units were used for loafing, courting, brood rearing and for feeding as the submergent plants appeared. No muskrats live in these units.

On the Lake Front Club an attempt was made in 1968 to determine if *Gambusia* fish would be effective in destroying mosquito larvae in the flooded salt grass of the unmodified units. On July 22, 1968, 2,000 *Gambusia affinis affinis* Baird

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and Girard were introduced into three of the more remote modified units located between unmodified units. About 700 fish were planted in each unit. The *Gambusia* survived and rapidly increased in numbers but did not penetrate more than a few feet into the salt grass of the unmodified units. As a result there was no appreciable reduction in the number of mosquito larvae on the unmodified units attributable to the *Gambusia*. The number of *Gambusia* present may have been inadequate in numbers to be effective, except to a limited extent around the margins of these units. It is possible that further penetration of the fish into the salt grass could be attained by a much greater fish population.

STUDY AREA: FARMINGTON BAY WATERFOWL MANAGEMENT AREA. In July, 1968, the #4 small experimental unit on the Farmington Bay Waterfowl Management Area was modified to: (1) further test the validity of the results obtained in mosquito larvae reduction from the shore line modification studies conducted on the Lake Front Club; and (2) study the effects of a change in the emergent vegetation on the mosquito larvae present in this unit.

The #4 unit shown and briefly described by Rees and Winget (1968) was constructed in 1966. It contains .24 of an acre, with water depths varying from 4–10 inches except in the borrow pit where the water initially was 48 inches deep. During 1968 the water in the unit was held at a fairly constant level throughout the season. This unit has been inspected for mosquito larvae at least once each week during the mosquito season since its construction in 1966.

A summary of the changes in the dominant emergent vegetation and mosquito larvae present is contained in Table 1. In this table it is shown that modifications were made on one-half of this unit during the first week of July. The other half was unaltered.

In the modified half, all of the cattails were removed. This required the removal of 70 percent of the dominant emergent vegetation. After the cattails were removed, salt grass sod was obtained from the adjacent marsh and planted in the unit where the cattails had been removed. The sod was arranged on the shore line of the unit in 6-foot-square blocks alternating with plots of open water of equal size.

During the remainder of the season, in the unaltered half of unit 4, *Culex tarsalis* and *Culiseta inornata* larvae were present but *Aedes dorsalis* larvae were eliminated.

TABLE 1.—Experimental unit no. 4, .24 acre, Farmington Bay water level constant; water depth 4–10 inches.

	1966	1967	1968		
	7/1 - 9/30	4/15 - 9/30	5/1 - 6/30	7/1 - 9/30	
PER CENT				UNMODIFIED 50%	MODIFIED 50%
OPEN WATER	10	10	10	10	60
SALTGRASS	50	20	10	10	30 TRANSPLANT
ALKALI BULRUSH	30	30	10	10	10 UNDISTURBED
CATTAIL	10	40	70	70	0 REMOVED
AVE. NO. LARVAE PER DIP	0.5 - 7.0	0.1 - 0.3	0.1 - 0.5	0.1 - 0.6	1.7 - 4.0 SALTGRASS ONLY
MAX. NO. PER DIP	34	24	1	2	26
PER CENT					
AEDES DORSALIS	2	32	7	0	20
CULEX TARSALIS	97	55	93	92	80
CULISETA INORNATA	1	13	0	8	0

In the modified unit the number of *Aedes dorsalis* larvae increased substantially to 20 percent of the larvae collected, with the balance consisting of *Culex tarsalis*. The *A. dorsalis* larvae were confined to the introduced salt grass plots and none appeared in the adjacent open water. The salt grass sod undoubtedly contained *A. dorsalis* eggs when introduced. Some larvae of this species continued to appear during the remainder of the season although the salt grass sod was continuously covered with water after the initial flooding. The continued appearance of these larvae could have been the result of a delay in hatching of some of the eggs in the sod or from eggs lying on exposed marginal surfaces of the sod.

As a result of this study on unit 4, as summarized in Table 1, it is evident that cattails in approximately 2 years increased from 10 to 70 percent of the vegetation present, proportionally replacing the alkali bulrush and salt grass in that order. As the cattails increased in number with water levels remaining constant, *A. dorsalis, C. tarsalis,* and *C. inornata* larvae decreased in numbers until they were virtually eliminated.

Culex tarsalis larvae appeared with *A. dorsalis* larvae in the salt grass sod soon after it was transplanted into unit 4 and continued in abundance during the remainder of the season.

In small open water plots adjacent to the salt grass plots no mosquito larvae appeared in 1968. This supports findings on the Lake Front Club where shore line modifications eliminated all mosquito larvae during the three seasons of this study.

CONCLUSIONS

1. Shore line modifications as conducted on these marshes are an effective method of completely eliminating mosquito larvae production in the shallow salt grass margins of water impoundments.

2. This control method has been effective for 3 years and existing conditions indicate it will continue to be effective for several more years in most of the units.

3. Modifications of the shore line, as applied on the Lake Front Club, have enhanced waterfowl use. This may not be the case if the adjacent unmodified units were removed and the entire shore line modified for mosquito control.

4. On these marshes, where water is retained during the year at a depth of about 12 inches, cattails tend to replace alkali bulrush, salt grass, and associated marsh vegetation.

5. As the cattails increase, mosquito larvae tend to decrease proportionately in numbers until eliminated.

References Cited

REES, DON M., and WINGET, ROBERT N. 1968. Water management units and shore line modifications used in mosquito control investigations. Mosq. News 28(3):305–311.