

Geomorphic Alteration of Tidal Wetlands by Mosquito Control Agencies

**John E. Potente,
Committee on Vector Control Long Term Plan
Suffolk County Council on Environmental Quality
Suffolk County Department of Planning, Suffolk County, NY**

The remaining 17,000 acres of tidal wetlands of Suffolk County, New York may now be subject to major recontouring instituting artificial ponds and creeks as a result of a recent county Long Term Plan for mosquito control. The plan was architected by the Suffolk County Division of Vector Control, received its rationale support from a contracted consultant, and was then submitted in the form of an Environmental Impact Statement (EIS). Upon review of the marsh management plan, Suffolk County's environmental review board, the Council on Environmental Quality (CEQ), found fundamental flaws and inconsistencies with the proposed plan. In its recommendations to the legislature, the CEQ urged: "The use of these 'Best Management Practices' are not substantiated as vector control or marsh restoration techniques." The Suffolk County legislature overrode the recommendations of its own environmental review board, the CEQ, and passed the legislation allowing for the controversial marsh manipulations.

Much of the tidal wetlands of Suffolk County, as well as neighboring coastal wetlands of eastern North America, has been previously affected by hydrological manipulations by mosquito control agencies which began early in the twentieth century. In an effort to depress mosquito populations emanating from salt marshes, parallel linear ditches were dug from the high marsh zones through the low marsh and out to estuarine bays, creeks and rivers. In many cases, supplementary ditches were also dug at right angles cross-connecting the linear ditches thus creating a grid pattern of ditches on the marsh surface. The intent was to remove the standing water of the marsh surface in which the marsh mosquitoes develop through their larval stages. However, after decades of the digging a network of ditches, the mosquitoes still flourish in the salt marshes. The integrity of the marshes, however, was compromised as the continuity of the high marsh was fragmented and bare areas between the ditches appeared. Opportunistic plants such as *Phragmites australis* took advantage of the disturbed soil and began invading valuable high marsh habitat. Repetitive accretion of silt brought in with high tides leads to natural reversion in many cases. However, the mosquito control agencies counter the natural processes by removing the waterborne silt from the ditches and redepositing it in the nearby vicinity.



Linear mosquito ditches



Mosquito grid ditching

In the 1960's it was recognized that the extensive system of ditches was causing detrimental effects of fragmentation and undesirable vegetative alteration of the high marsh habitat. While many county and state mosquito control agencies continue to maintain the system of ditches, others turned to integrating a concept of Open Marsh Water Management (OMWM). Inherent in its suite of "best management practices" is the digging of ponds in the high marsh. These ponds are often superimposed upon areas identified by mosquito control agencies as mosquito breeding locations. As the ponds are excavated, the spoil from these sites is either spread over the existing adjacent areas or used to fill some adjacent ditches. In a complete turnaround of hydrological preferences, the mosquito agencies adopting this regime look to introduce standing water on the marsh surface in lieu of draining the marshes. The new theory was advocated in anticipation of luring more killifish (predators of mosquito larva) to the high marsh.



Removal of marsh vegetation and marsh peat to create artificial ponds

While this regime of digging ponds in tidal wetlands has been executed by a number of mosquito control agencies, there has been no reliable study to substantiate the claim that it does, in fact, reduce mosquito breeding in high marsh habitat. Suffolk County allocated \$4,000,000 towards the development of its Long Term Plan for mosquito control. The centerpiece of this plan was a pilot project to study the effects of OMWM ponds upon a tidal marsh. Ducks Unlimited acted as the intermediary between the US Fish & Wildlife Service (USFWS) and the Suffolk County Division of Vector Control to gain access to the marshes of Wertheim National Wildlife Refuge as the project site.



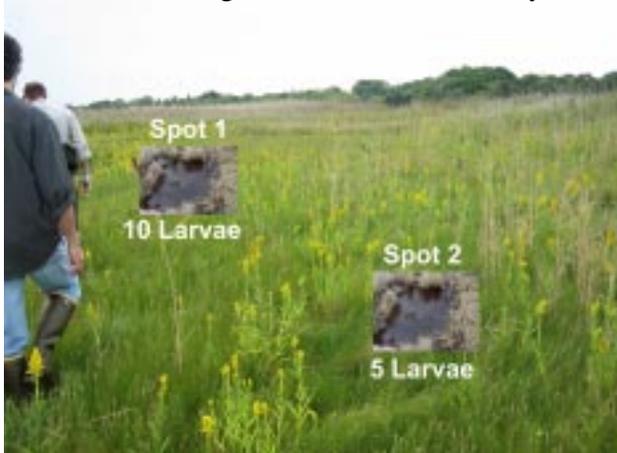
Marsh Ponds dug in Wertheim NWR

A portion of the tidal wetland zone of Wertheim was chosen as the test site. It was divided into four study plots of forty acres each. Pre-project monitoring on all four areas took place. In March 2005, Area 1 received pond excavation. In March 2006, Area 2 received pond excavation. Area 3 and Area 4 were used as control sites. Preliminary results are being touted as indication that the study is proceeding successfully and that the goals of mosquito reduction are being met. (Tonjes)

A number of serious flaws raise question as to the procedural activities and reliability of data of this project. The short duration of pre-project monitoring, the inconsistent methodology of data collection and the inherent bias of the field surveillance operators all contribute to undermining the short term-claims and future conclusions of this study. The New York State Department of Environmental Conservation (NYSDEC) reluctantly consented to granting the permits for this project to be performed in protected wetland habitat. Subsequently, the NYSDEC and the New York State Department of State both raised objections to the inadequacy of the pre-project baseline data duration.

Where data for mosquito breeding areas was collected, auxillary methodology was used which is inconsistent with accepted scientific protocol. "Modifications" to the monitoring for mosquito larvae were applied in this study (Tonjes). As stated in the EIS Supplement authored by the Division of Vector Control and the consultant, "While larvae/dip and number of dips is recorded, it would be inappropriate to use analytical tools base on random sampling on this information, because the dips are not taken randomly, they are targeted." Targeting leaves the choice of sampling locations to the discretion of the field sampler.

This subjective sampling scheme can easily bias the results of a study. A field sampler could bias the number of mosquitoes collected by searching for and collecting samples only in those areas with active breeding when sampling in a control area or an area that has yet to undergo marsh ponding. Conversely, this same sampler may not search as hard for actively breeding mosquito locations when sampling a site that has undergone marsh manipulation for the purpose of mosquito control. By deviating from fixed locations and deciding each successive sample location at will, the field collector is, in essence, determining the outcome of the study.



Pre-project target sampling

Field monitors may target sample Spot #1 and overlook sample Spot #2.

The pre-project data will show 10 mosquito larvae before the ponds are dug.

However, if you look at spots # 1 and # 2 for both pre-project and post-project, you will see that, in this case, they have both retained the same number of mosquito larvae.



Post-project target sampling

After the ponds are dug (upper right in photo) the field collectors return to the site. But now they may choose to sample from Spot #2 and avoid Spot # 1.

Post-project data will indicate 5 mosquito larvae.

This data collection technique will support the claim that digging ponds are a success.

Mosquito agencies and Ducks Unlimited have initiated OMWM projects on a number of national wildlife refuges up and down the east coast. Mosquito agencies are presumably looking to reduce mosquito populations for nearby communities. And Ducks Unlimited, a hunting organization, has a stake in the marshes, looking to boost duck populations. After experiencing a number of OMWM operations on its protected marsh areas within national wildlife preserves, the USFWS decided to conduct its own study.

The USFWS conducted a rigorous five year multi-site study from 2001 - 2005. It sampled mosquito larvae along fixed transects dispersed throughout the marshes. The first sample plot on each transect was randomly located and all other plots were systematically located at fixed distances (e.g., 20 m.) along the transects. This arrangement of sampling locations assures adherence to statistical independence. The finding of the USFWS report concerning mosquito production after implementation of OMWM is: “No differences in mosquito larval density were observed for any of the study locations.”

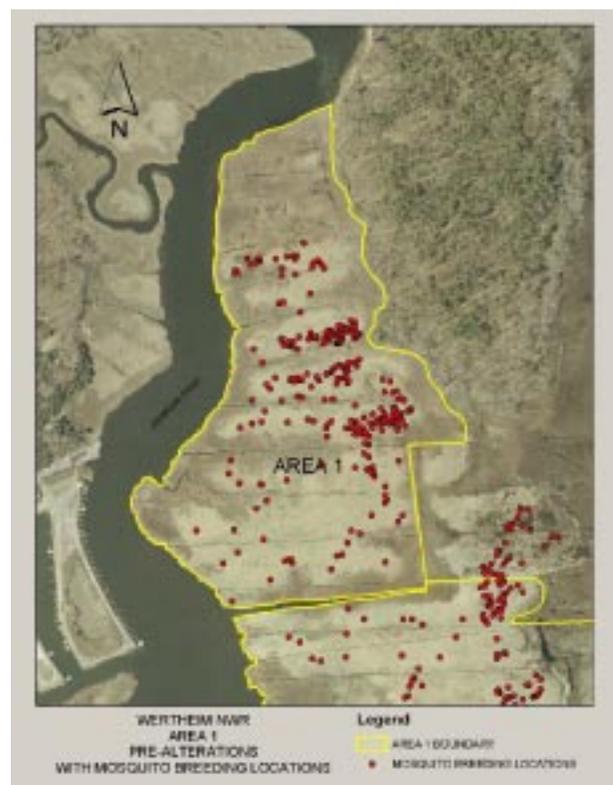
While the study for mosquito larval densities conducted for Suffolk County and reported by the contracted consultant (Tonjes) includes the technique outlined by James-Pirri et al (USFWS Report), it also took the liberty to “modify” the methodology. When conforming strictly to the fixed transect technique, the data may yield results contrary to what the Division of Vector Control desired. “Target samples” are utilized for validation of results by the Division of Vector Control and the consultant to demonstrate that the construction of artificial ponds are beneficial for mosquito control. However, inclusion of target samples along with transect samples as raw data renders findings indefensible.



FIGURE 1-5
SUFFOLK COUNTY VECTOR CONTROL
OPEN MARSH WATER MANAGEMENT
DEMONSTRATION PROJECT
AREA 1

Area 1 Pre-project

An accepted method of mosquito sampling has collection points at fixed intervals along a transect.



Area 1 Pre-project data

Note the erratic collection points in red. This is indicative of target sampling

Finally, we must consider the background of the field data collectors. In addition to the built in opportunity for steering the results, field collectors that would hardly be considered unbiased were contracted to do the data collection for the study. The primary entity responsible for field collection for pre-project monitoring of Area 1 and Area 2 was Ducks Unlimited. While contributions were made by Division of Vector Control and USFWS, how is it that a duck hunting organization was subcontracted to collect scientific data that would determine the fate of Suffolk County's remaining 17,000 acres of tidal wetlands? This choice of a national organization anxious to see more marsh ponds that would lure more ducks for gunshot raises an eyebrow. Are National Wildlife Refuges established and maintained as refuges for wildlife or as hunting playgrounds? Curiously, duck hunting is now being anticipated and considered at Wertheim National Wildlife Refuge.



The marriage between mosquito control agencies and Ducks Unlimited abetting each other establishes a formidable force in the promotion of ponds in marshes. While their motives may be clear, the deviation from scientific rigor in their studies leaves the justification of ponding marshes for mosquito control faltering. It should be fully recognized that any conclusions drawn from the pilot project at Wertheim NWR by the Suffolk County Division of Vector Control or by the contracted consultant (Tonjes) as to the efficacy of digging ponds in marshes for mosquito control are based upon short-term baseline data, incongruent methodology, and field data collected by a duck hunting organization.

References

James-Pirri, M.-J., 2005 US Fish & Wildlife Service (Region 5) Salt Marsh Study, Newington, NH

Suffolk County Vector Control & Wetlands Management Long Term Plan & Environmental Impact Statement Supplement 2007

Tonjes, D.J., 2007 Preliminary Data on the Impacts of the 2005-2006 Water Management Project at Wertheim National Wildlife Refuge, Shirley, NY (Fourteenth Conference on "Geology of Long Island and Metropolitan New York")