HOW MOSQUITO ABATEMENT AND WETLAND DESIGN CAN HELP REDUCE MOSQUITO BREEDING

By Dan Strickman – April 14, 2005

The salt marsh habitat can be a piece of wilderness nestled between the Bay and the city. It provides more mass of plant material per acre than an agricultural field, cycling more nutrients and producing more oxygen. The salt marsh is also home to a vast complex of animal species, including the well-known and well-loved salt marsh harvest mouse and clapper rail. There are many other species that are important to the ecology of the marshes and each responds to a different set of conditions that either increase or diminish their numbers. Human influence within the salt marsh can radically change those conditions, with consequent changes in the number of individuals of any of the thousands of species of invertebrates and vertebrates.

For the most part, the indirect affects of this kind of human influence go unnoticed because the outward appearance of the marsh remains within the range of conditions considered natural. Mosquitoes of the salt marsh are an important exception – uncontrolled they would make large parts of the region uninhabitable during a significant portion of the year. In the Bay area, there are three important species of mosquitoes that develop as larvae in salty, quiet water located amid the pickle weed, alkali bulrush, and alkali heath. One species, *Aedes squamiger*, is endemic to California and only lives in the estuaries along our coast. The larvae develop in cold, salt water during four or five months in the winter, then emerge in hordes in the early spring. The females move inland up to 20 miles, creating a major nuisance as they bites people in the cities. The mosquitoes then return to the salt marsh to lay their eggs, which quietly spend the summer in the soil until they are flooded by cold salt water in the fall. Another, *Aedes dorsalis*, occurs world-wide and has a life cycle similar to that of *Aedes squamiger*, except that it can have many generations per year and it requires warm water to complete development in about 10 days. Because *Aedes dorsalis* is a summer mosquito and our rains come in the winter, its development is restricted by the unusual events that lead to summer flooding of the upper reaches of the marsh. Finally, *Culex tarsalis*, an important vector of West Nile virus, develops in brackish warm water in the upper areas of the marsh. *Culex tarsalis* lays its eggs directly on the water and is most abundant in the spring and fall.

Although natural members of the salt marsh ecosystem, the number of individuals of these mosquitoes is held in check by a two important factors in fully tidal marshes. First, they all require quiet water with vegetation. Second, fall populations of *Culex tarsalis* and summer populations of *Aedes dorsalis* require flooding of the upper portions of the marsh during the warm part of the year. In a fully tidal marsh, the twice daily flow of the tide prevents mosquito larval development in even small channels. The summer

mosquitoes are further restricted by the absence of rains and the generally low tides of the season. Human activity can favor mosquito development by restricting tidal flow with dikes or levees and by flooding salt marshes during the warm season, usually for upstream water management or in an attempt to oxygenate water within diked marshes.

Within Santa Clara County, our worst mosquito sites are formed from diked marshes. Although these sites serve important wildlife and botanical habitat functions, they produce mosquitoes by the billions. In order to prevent a major problem for the community, hundreds of thousands of dollars are spent each year to kill the mosquito larvae at these sites. Two examples are the Palo Alto Flood Basin and New Chicago Marsh. The Palo Alto Flood Basin has a tidal gate, but the flow through the interior of the 800 acre site is inadequate to disrupt larval development. When winter rains add water to high tides, large parts of the basin become ideal developmental sites for *Aedes squamiger.* In the spring, lingering brackish water supports large populations of *Culex tarsalis*. In the summer, attempts to oxygenate the water by allowing inflow of more tidal water hatches off eggs of *Aedes dorsalis*. The problem at the 200-acre New Chicago Marsh is simpler because the site is essentially a basin with no tidal influence at all. Winter rains raise the level of water in the marsh and hatch huge stores of eggs of *Aedes squamiger*. Most of these larvae would develop successfully to mosquitoes unless they were treated.

In contrast, the fully tidal marshes along the South Bay produce very few mosquitoes and generally require no treatment. Located in San Mateo County, Greco Island is the largest area of undisturbed, primary tidal salt marsh in the South Bay. Despite its well-developed vegetation and large area, it produces almost no mosquitoes. Another example is Triangle Marsh near Coyote Creek in Santa Clara County. It is very close to some diked marshes that produce huge numbers of mosquitoes, but the water in Triangle Marsh flows through channels twice a day and does not support larval development. Although outside of the San Francisco Bay estuary, Elkhorn Slough provides a very dramatic example of the indirect influence of human activity on mosquito production in salt marshes. Elkhorn slough is bisected by a railway that sits on an earthen bed. The rail bed forms an unintentional dike across the slough. Though there are tide gates in the rail bed, the flow to the portion of the slough to the southeast is restricted and there are literally square miles of mosquito habitat. The fully tidal portion of the slough northwest of the rail bed has not required treatment for mosquitoes during at least the last 25 years.