DELAWARE MOSQUITO CONTROL SECTION

FAQ #4. Why do you have to use insecticides at all? Aren't there better ways to achieve control? What other approaches do you use?

Modern insecticides are but a tool that mosquito control professionals can call upon in their IPM programs to help reduce or suppress intolerable numbers of mosquitoes. As with all pesticides, there is always the chance in using an insecticide that something might go wrong, or that a product's use might have unintended consequences that are not foreseen. However, the development process for modern insecticides, given the extensive and intensive product review and registration process that is conducted by the U.S. Environmental Protection Agency (EPA), helps to ensure to the extent practicable that today's use and application of modern mosquito control insecticides is done as safely as possible, and that any risks from adverse impacts to humans, wildlife or environment are extremely minuscule. In fact the EPA has declared that when these registered products are used in accordance with all label language requirements and conditions, which by federal law they must, then their use "poses no unreasonable risks to human health, wildlife or the environment." In terms of risk-benefits, problems that mosquitoes cause for quality-of-life, public health or local economies are far greater issues than the deminimus or very small risks that might be associated with infrequent exposure to mosquito control spraying. More information about the safety of our mosquito control products is provided in FAQ #5.

Having said this, **the Mosquito Control Section still prefers wherever practicable to use non-insecticide control methods**, since the exceedingly small risks that might be associated with mosquito control spraying obviously go to zero if or where no spraying is done. The most practicable alternatives to using insecticides are a category of control methods collectively called **source reduction**, which through various approaches either eliminate mosquito-producing habitats, or somehow control mosquitoes in their pre-emergence larval stages. One example of source reduction was mentioned in FAQ #1, whereby property owners practicing good water sanitation around their homes or businesses can measurably help to reduce mosquito-production habitats. Public education and cooperation is the key to this type of domestic water sanitation source reduction.

However, many breeding habitats are too large, or in too remote or inaccessible areas, for private citizens to be able to provide much help for source reduction, which is where the Mosquito Control Section must then act. Because of the long flight ranges of saltmarsh mosquitoes and the remote wetland areas where these mosquitoes are often produced, the Mosquito Control Section devotes a lot of its efforts to managing saltmarsh habitats for reduction of mosquito production, including using a source reduction technique known as **Open Marsh Water Management (OMWM)**. The OMWM method selectively excavates small, shallow ponds and ditches in mosquito-production areas of the high salt marsh, which in doing helps eliminate or reduces egg-deposition habitats for saltmarsh mosquito species (which require moist muds for their egg-laying), and which then also provides permanent water habitats for resident native fishes (e.g. killifishes, *Fundulus*) that are voracious predators upon mosquito larvae. All OMWM wetland

alterations are done under regulatory oversight by the **Delaware Mosquito Control Advisory Committee** (DMCAC), consisting of four federal agencies (Army Corps of Engineers, U.S. Environmental Protection, U.S. Fish and Wildlife Service, National Marine Fisheries Service), three DNREC agencies (Division of Fish and Wildlife, Wetlands and Subaqueous Lands Section, Delaware Coastal Management Program), and the State Historic Preservation Office.

Most OMWM alterations are not directly connected to daily tidal flows, such that OMWM ponds and ditches do not typically drain or dewater marsh surfaces of their standing water bodies, nor excessively lower the marsh subsurface water table. This helps to control saltmarsh mosquitoes without insecticides in a manner that avoids the previously detrimental ecological impacts of the **old parallel-grid-ditch system**, which were open tidal ditches geometrically spaced about 150-feet apart, traversing much of Delaware's tidal wetlands (in both mosquito-production and non-production areas), with intention to drain or dewater marsh surfaces. The parallel-grid-ditches were constructed by the Civilian Conservation Corps in the 1930's, and these ditches were periodically recleaned of accumulated sediments into the 1970's. The open, tidal parallel-grid-ditches had adverse impacts on saltmarsh habitats by draining many shallow ponds and mudflat areas that were valuable fish and wildlife habitats, and in some areas through spoil deposition (from the ditch excavations), or by lowering of the subsurface water table by low tide drainage, caused undesirable vegetation changes (e.g. incursions of marsh shrubs such as *Iva* or *Baccharis,* or the reed grass *Phragmites*, in ditched areas). Furthermore, while the old parallel-grid-ditches helped to reduce mosquito production in some areas, these ditches were still not effective enough to achieve the desired level of control needed in many locations, because mosquito-production habitats between the parallel-grid-ditches (particularly the small "pothole" depressions) were not drained.

Today's **modern OMWM technique** avoids these problems by using specialized excavation machinery that does not cause excessive increases in marsh elevations from spoil deposition (e.g. a rotary excavator, which broadcasts excavated spoil as a thin slurry over the marsh surface); by OMWM system design and excavated alterations that do not lead to excessive lowering of the subsurface water table; and by actually satisfactorily controlling almost all mosquito production in areas that are treated. Furthermore, the installation of OMWM systems as overlays upon old parallel-grid-ditch networks helps to restore standing surface waters to the marsh valuable as fish and wildlife habitats, thereby restoring some lost wetland values and functions. Unfortunately, OMWM cannot be used everywhere saltmarsh mosquitoes breed, because of factors like not having marsh landowner permission or cooperation (for a variety of reasons); by site access considerations for heavy machinery; by other environmental considerations (e.g. leaving intact the relatively little salt marsh acreage in Delaware, and within the entire Northeast too, that still remains undisturbed by any type of alteration, such as what is found at Bombay Hook National Wildlife Refuge); or by project size or project scale (it's not usually cost-effective to treat small marsh areas or small amounts of mosquito production with OMWM, especially when there are so many larger areas of the State's coastal wetlands still needing OMWM treatment). Wherever there are problematic salt marsh habitats that cannot be treated with OMWM, then judicious use of insecticides must be

employed; and because of the scale of the problems encountered in salt marshes, usually treated via aerial spraying by fixed-wing aircraft, or sometimes if more localized treated via helicopter. Installing OMWM systems is a labor- and capital-intensive undertaking, but in the long-run is usually more cost-effective than continual periodic treatments with insecticides.

Other types of source reduction practiced by the Mosquito Control Section include **management of tidal flows or exchanges and marsh water levels** to discourage or control mosquito production in **coastal wetlands impoundments**, which on federal, state and private lands total over 10,000 acres of Delaware's >90,000 acres of coastal wetlands. These impoundments are areas of marsh that are diked-off with levees, whose interior waters are then managed by various types of water control structures for multiple environmental goals and objectives, including flood prevention, stormwater management, waterfowl production and hunting, habitats for wading birds and shorebirds, estuarine fish nursery areas, crabbing and fishing, saltmarsh mosquito control, nature study, canoeing, etc. Along with our other colleagues in the Division of Fish and Wildlife, the Mosquito Control Section plays a major role on State lands in helping to maintain and manage these valuable wetland units.

It is not always possible (nor desirable) to manage tidal exchanges or marsh water levels in impoundments for only one purpose, so sometimes it's not always possible to achieve satisfactory mosquito control in impoundments through water management alone, which might then necessitate some judicious insecticide spraying (using larvicides), usually with a helicopter, but sometimes in more expansive impoundments by fixed-wing aircraft. **Shallow ponds and ditches** can also be excavated **within impoundment interiors** to help control mosquito production, but these features are often difficult to maintain because of the unconsolidated nature of many impoundment bottoms, which then tend to rapidly fill-in any excavations that were made, routinely requiring re-excavations. However, where still cost-effective to routinely do this periodic re-excavation, and in order to reduce insecticide use or maintain or enhance fish and wildlife habitats, the Mosquito Control Section is committed to undertaking this impoundment source reduction work.

Another type of source reduction performed by the Mosquito Control Section involves the **stocking of mosquitofish** (*Gambusia*) in freshwater mosquito-production habitats, such as in stormwater management basins that are often associated with subdivision developments or highway projects, or in small natural or ornamental ponds. Unfortunately, fish survival cannot always be ensured in many of these locations, because of water volume or water quality problems, and often because of too cold overwintering temperatures, eliminating the stocked fish. The rearing and distribution of mosquitofish is also very labor intensive. Additionally, stocking mosquitofish in some natural areas cannot be done because of concerns about adverse impacts to native fishes through interspecific competition, or because of concerns about predatory impacts upon amphibians of special concern. Unfortunately, there is not a freshwater "OMWM-equivalent" method for dealing with non-tidal mosquito production problems found in freshwater wetlands or wet woodlands. When source reduction using mosquitofish cannot

be employed, then these types of habitats must be treated with insecticides (primarily larvicides), often done by hand or ground-application equipment. Finally, in regard to source reduction approaches for stormwater management basins, there are considerations in a basin's design and construction, and in management of its water levels, that will help to reduce mosquito production, all which are encouraged to be followed by developers or other agencies.

Other types of source reduction are possible, but unfortunately their overall effectiveness is usually not satisfactory, or is often not up to what one is sometimes led to believe will occur. For example, encouraging on your property through nesting structures colonies of **purple martins** (via elevated, multi-chambered "houses") certainly cannot hurt, but scientific studies have shown that when mosquito production is even moderately high, and the production problem emanates from expansive nearby areas, that these birds are really not very effective at all in reducing mosquito infestations, even for achieving the local relief that might be desired. Part of the problem stems from purple martins actively flying and feeding only during daytime only, whereas many mosquito problems are most pronounced during twilight periods or dark (the birds might have more of a beneficial effect here via controlling daytime biting greenhead flies, deer flies, or biting gnats). If one is looking to encourage airborne predators to help combat local mosquito problems, building **bat houses** to encourage colonization by nocturnal flying bats is probably more effective; but then one has to also tolerate having bats around, which aesthetically some people (especially neighbors) might not like, not to mention concerns about bats carrying and possibly transmitting rabies.

The **electronic "bug zappers"** that are so popular in some neighborhoods have been scientifically shown to really be of very little value in controlling mosquito populations, and have also been documented to have adverse impacts on non-target insect species. **Commercial mosquito collection/killing traps** (e.g. Mosquito Magnet, Mosquito Deleto), some which are rather sophisticated with lights, fans and sources of carbon dioxide or other attractants (e.g. octenol), might be marginally effective in some localized situations. However, because of their relatively high expense (several hundred dollars) and limited areal effect (supposedly about ½-acre), these devices are really not very effective for contending with larger-scale problems, and hence not very practicable to consider using for large-scale needs or operations. But this is not to say that these devices cannot provide some very localized relief in your backyard setting, if not in terms of a noticeable drop in the numbers of mosquitoes that are biting you, then perhaps at least for psychological relief, in that you're at least doing something to help kill some skeeters.

Finally, it should be noted that the mosquito control profession is always on the lookout for more efficacious, cost-effective control methods that also lessen any non-target impacts. Various alternatives have been proposed or arisen, and many have been tested, such as introduction in the field of irradiated, sterilized adult male mosquitoes or genetically manipulated mosquitoes to try to lessen reproductive potential; the introduction of fungi, protozoans, nematodes or other microbial pathogens to infect and kill mosquito larvae; the introduction of mosquito species that as larvae prey upon other mosquito larvae ("cannibal" mosquitoes); etc. However, while these alternatives might

look good in theory or in the lab, in terms of their performance in the field, or in regard to their practicability for large-scale operations, they have so far not been satisfactory. To this category might also now be added trying to use ultrasonic sound waves to physically kill larvae by rupturing air pockets or bladders within their bodies, which shows some promise in smaller or tightly confined aquatic habitats (e.g. Larvasonic for treating storm sewer catch-basins), but awaits further research in terms of control efficacy, non-target impacts, and practicable utility. In collaboration with academic researchers and product manufacturers, we are always seeking "new chemistries" or other improved technologies for potential adoption for our control toolbox (e.g. insect growth regulators, ovipositioning repellents, algal- or plant-produced toxins, population autoinhibitors, molecular or DNA-based insecticides), perhaps leading to yet another generation of further improved insecticides.

More information about the Mosquito Control Section's options and choices for dealing with mosquito production problems can be found on the Section's Internet website at http://www.fw.delaware.gov/Services/Pages/MosquitoSection.aspx.