FAQ 4. Why do you have to use insecticides? What other methods are used?

Modern insecticides are a tool that mosquito control professionals can use in their Integrated Pest Management programs to help reduce or suppress intolerable numbers of mosquitoes. The extensive product review and registration process that is conducted by the U.S. Environmental Protection Agency (EPA) during the development process for modern insecticides helps ensure 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 minimized. The EPA has declared that when these registered products are used in accordance with all label requirements and conditions, as required by federal law, 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 than the 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.

The Mosquito Control Section still prefers wherever practicable to use non-insecticide control methods, since the minimal risks that might be associated with mosquito control spraying are zero if 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 control mosquitoes in their pre-emergence larval stages.

Due of the long flight ranges of saltmarsh mosquitoes and the large and remote wetland areas where these mosquitoes often breed, the Mosquito Control Section devotes part 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 helps eliminate or reduces egg-deposition habitats for saltmarsh mosquito species, and which then also provides permanent water habitats for resident native fishes (e.g. killifishes, *Fundulus*) that are voracious predators of 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. 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.

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. **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. 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 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 freezing overwintering temperatures. 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 certain amphibians. 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. Finally, in regard to source reduction approaches for stormwater management basins, there are considerations to a basin's design and construction and the management of its water levels that will help to reduce mosquito production.

Other types of source reduction are possible, but unfortunately their overall effectiveness is usually not satisfactory. For example, installing **purple martin** houses on your property certainly cannot hurt, but scientific studies have shown that when mosquito production is even moderately high these birds are not very effective in reducing mosquito infestations. Part of the problem stems from purple martins actively flying and feeding only during daytime, whereas many mosquito problems are most pronounced during twilight periods or dark. 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 some people (especially neighbors) might not like.

The **electronic "bug zappers"** that are so popular in some neighborhoods have been scientifically shown to be of 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, 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 not very effective for contending with larger-scale problems. This is not to say that these devices cannot provide some very localized relief in your backyard setting.

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 not been satisfactory so far. 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.