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Mosquitoes and Public Health: Protecting a Resource in the Face of Public Fear

Mosquitoes and Fire Island. The two are synonymous for the millions of visitors who come to Fire Island National Seashore every year, for the 30,000 people who live within the park, and for the additional hundreds of thousands who live within five miles of the island. When the mosquito-borne West Nile Virus (WNV) arrived in the New York area in 1999, mosquitoes became the object of a whole new sense of danger and fear to the public. The response of the National Park Service (NPS) and Fire Island National Seashore became a critical element in protecting the extensive bay marshes and wetlands in the national seashore while responding to public health concerns.

A History of Conflict

Fire Island National Seashore was established in 1964 “for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features within Suffolk County, New York, which possess high values to the Nation as exam-

ples of unspoiled areas of great natural beauty...” (P.L. 88-587). In that law, NPS is charged to “administer and protect the Fire Island National Seashore with the primary aim of conserving the natural resources located there.” In 1980, Congress further established within the national seashore the Otis Pike Fire



Figure 1. Part of the designated wilderness at Fire Island National Seashore.

Island High Dune Wilderness, the only wilderness in the National Park System in the northeast U.S. This gave these lands in the eastern end of the park a protection afforded by the Wilderness Act, in addition to National Park System protections. It is in this wilderness that the mosquito populations are at their highest.

Fire Island National Seashore encompasses 26 miles of a 32-mile-long island. The park also includes more than 20 smaller islands, bay waters, and the detached 612-acre William Floyd Estate. On the island and within the boundary are 17 communities that contain a summer population of some 30,000. Almost from its inception, the management of mosquitoes in the marshes has been a source of discussion and disagreement between the NPS, Suffolk County Vector Control, and Suffolk County Department of Health Services officials. A cursory investigation of correspondence dating back to 1976 between the county, local elected officials, members of Congress, national seashore staff, and Department of the Interior officials in Washington reveals that a tug of war over mosquito management policies has been the norm. Concerns over nuisance mosquitoes biting park neighbors, island residents, and visitors have been interspersed with public health concerns over the transmission of Eastern Equine Encephalitis (EEE).

| In the early 1980s, NPS was be-

sieged with letters demanding action to alleviate mosquitoes. The concerns primarily focused on the east end of the national seashore where the island is closest to the mainland. The extensive marshes are hatching grounds for a variety of the more than 75 species of mosquitoes found in New York. Primary among them is *Aedes sollicitans*, a particularly voracious biter that can fly up to five miles and feeds primarily from dusk to dawn. Residents of the communities of Mastic, Mastic Beach, and Shirley, which lie across the bay from these marshes, complained that the mosquitoes from Fire Island were the source of their concerns. Though NPS is sympathetic to the nuisance of mosquitoes, it remained opposed to using pesticides to address merely a nuisance issue. In response to complaints, NPS commissioned a study of mosquito dispersion, conducted by Dr. Howard Ginsberg. The purpose of the study was to determine the range of the mosquitoes from these marshes. The Centers for Disease Control and Prevention (CDC) and the U.S. Public Health Service (USPHS), in cooperation with NPS, assessed the health risks of mosquitoes on eastern Fire Island. Based upon Dr. Ginsberg's three-year study and the CDC study, no significant risk of EEE from the mosquitoes on Fire Island was found, and it was determined that a small portion of the total mosquitoes on Fire Island make it to the mainland. This science did little to dispel public concerns.

Policies and Guidelines

It is the policy of NPS not to use pesticides to control nuisance insects. The agency's management policies state: "Native species will be allowed to function unimpeded except ... to manage a human health hazard as defined by the Centers for Disease Control or to protect against a significant threat to public safety" (Chapter 4:13). In addition, mosquito management within the Seashore is specifically addressed in the general management plan for Fire Island National Seashore, which states that "the use of insecticides, herbicides and other chemical and petroleum products as widely applied flora and fauna control methods on federally owned tidal marshes and other lands will not be allowed." Use of pesticides in the wilderness was further addressed in the 1983 wilderness management plan for the park: "[T]he routine maintenance of existing ditches and the use of chemical pesticides [including *Bacillus thuringiensis*, or Bti] as mosquito control techniques will not be permitted."

Complicating these policies is the fact that Suffolk County Vector Control operates without restriction in the communities within the national seashore. Though these communities are interspersed with federally owned lands and the waters are connected, NPS has never sought to restrict or manage the use of pesticides in these areas. The general management plan does state that "use of these substances on non-fed-

erally-owned lands within the legislated boundary of Fire Island National Seashore will be discouraged," though there is no history of action on the part of NPS to do so. The legal case *U.S. v. Moore* established the authority of NPS to control the use of pesticides on non-federal land within a legislated boundary.

New Pressures

In 1997, I arrived at Fire Island National Seashore as the new superintendent. Less than two weeks into my assignment, I received my first mosquito complaint and a summons to the office of the local member of Congress. Once again the issue of mosquitoes and threats to public health and quality of life became the focus of concerns. Suffolk County Vector Control and the Suffolk County Department of Health Services insisted that the mosquitoes from the marshes were a threat and that NPS had to allow pre-emptive use of pesticides. The county preferred to use aerial applications due to the lack of roads on Fire Island. Health concerns centered on EEE, a disease that is about 50% fatal in humans. The fact that there has never been a human case of EEE in the county did not dissuade fears. It is understandable that the public would be concerned about this dangerous disease.

Biologically, it is a remote possibility for salt marsh mosquitoes to transmit EEE to humans. EEE originates in birds and is transferred primarily among birds by freshwater



Figure 2. Bog at Fire Island National Seashore.

species of mosquitoes. Mosquitoes on the eastern end of Fire Island are salt marsh mosquitoes, *Aedes sollicitans*. The types of freshwater swamps that typically produce EEE infections do not exist on the eastern end of Fire Island National Seashore.

The difficulty in helping the public to assess its health risks and their relationship to mosquitoes is that the means of transmission and the infection rate of mosquito-borne disease—whether EEE or WNV—are not easily explained. For example, salt marsh mosquitoes are capable of transferring EEE and WNV to people, but only under two scenarios:

1. An infected freshwater mosquito bites an uninfected bird in a freshwater habitat. This bird, now infected, flies to the national seashore's salt marshes, where spraying is not allowed. There, a previously uninfected salt marsh mosquito bites the infected bird. That mosquito is now infected. It must then bite a person for him or her to get EEE or WNV.
2. An uninfected salt marsh mosquito flies from the wilderness to the mainland. There, it bites an infected bird and acquires the EEE or WNV virus. This infected mosquito must then bite a person to pass on the virus.

Note, however, that in both cases not all mosquitoes that bite an infected bird actually acquire the disease.

These chains of events and their likelihood are lost on a general population that only knows that

mosquitoes are biting them, they don't like it, and they may get a deadly disease. In the summer of 1997, there was a series of meetings and discussions between NPS, the county, and the office of the local member of Congress. Newspaper articles and editorials blamed NPS for risking public health at the expense of protecting mosquitoes. Attempting to explain NPS policy on managing mosquitoes or the added responsibilities of a wilderness area were lost in the overwhelming anger over what was perceived as a cavalier attitude towards human health. This was culminated by Congressman Michael Forbes introducing language in the House Appropriations Committee calling on the operating budget of Fire Island National Seashore to be cut by 50% if the park did not take action to control mosquitoes in the wilderness. The language did not pass, but it was an indication of the depth of frustration among the public.

A New Course of Action

It was clear from the public and political attitudes that NPS could not continue to rely upon denials of culpability or explanations of the low risk of disease as support for its position. Nor could education alone dispel fears. Therefore, a new tactic was warranted. In 1997, we decided that NPS had to demonstrate its concerns for public health and take a preventative position to both preserve the marsh ecosystem and respond to public fears.

Working with Dr. Ginsberg, now with the U.S. Geological Survey's (USGS's) Patuxent Wildlife Research Center, the CDC, NPS's Integrated Pest Management Office in Washington, USPHS, and Suffolk County Vector Control, NPS developed a mosquito monitoring and testing program for the national seashore. The program was written and reviewed in the fall and winter of 1997-1998.

A Coordinated Program

The program, initiated in the spring of 1998, was a multi-pronged approach designed to address the three major concerns: public safety, public education, and resource protection. The elements of the program are as follows.

- Σ We restored the marsh at the William Floyd Estate. This consisted of plugging the "mosquito ditches" that were commonly built in the Northeast until the 1960s in order to restore a more natural open-water marsh. Studies in other areas have shown this kind of restoration restores fisheries and bird habitat—and reduces mosquitoes. The project was completed in the fall of 1999 with the cooperation of the U.S. Fish and Wildlife Service, Ducks Unlimited, Suffolk County Vector Control, the New York State Department of Environmental Conservation, and USGS.
- Σ We initiated a public education program through the production of a brochure entitled "Mosqui-

toes and You" that has been distributed widely. The brochure addresses the life cycle of mosquitoes, health risks, and personal disease-prevention techniques. It also contains tips to reduce the nuisance element of mosquitoes.

- Σ Park staff, including the superintendent and deputy superintendent, conducted a series of public meetings on the island and in nearby communities presenting the new program and answering questions about mosquitoes.
- Σ We have produced letters, a question-and-answer sheet, and news releases explaining both our management policies and our concerns for the protection of both public health and resource health by minimizing the use of pesticides.
- Σ We created a page on the park's Web site devoted to mosquito information.
- Σ We adopted an accelerated step-by-step response in the event EEE is discovered in mosquitoes on Fire Island or nearby communities. This procedure includes the use of pesticides on the mosquitoes should a disease risk materialize.
- Σ We hired a seasonal biologist each year for the past three years to implement the monitoring program.
- Σ With the arrival of WNV in 1999, we expanded the monitoring area to include NPS lands

along the entire length of the island.

The Monitoring Plan

The monitoring and response protocol is the heart of the program. This is a testing program coupled with a graduated escalation of response based upon results. Testing is done by the same laboratory as all county samples in order to coordinate findings with Suffolk County Vector Control and ensure that the state and county public health officials receive first notice of any positive hits for disease.

An essential part of the program is integration with the county and state mosquito management programs and reassurance to the local agencies, elected officials, and the public that NPS is paying attention to the issue, has public health as its foremost concern, and is actively involved.

The presence of WNV in or near the park, or of EEE in the park, or extraordinarily persistent or high levels of EEE infection in mosquitoes near the park, could trigger NPS interventions if conditions are such that (1) the conditions strongly suggest a disease risk to humans, (2) the risk of disease transmission would be substantially lowered by the intervention, and (3) mosquito management within the national seashore is superior to other approaches available to manage disease risk.

Interventions can include closing portions of the park to the public, the use of mosquito management meth-

ods such as applications of Bti to prevent emergences, or adulticide applications to areas with high levels of adults of *Culex* spp. or of *Aedes sollicitans*. The final decision on all management interventions within the park or the William Floyd Estate are made by the superintendent in accordance with NPS management policies.

Four levels of action, described below, are used: (1) routine surveillance, (2) intensified surveillance, (3) public notification, and (4) mosquito management. Critical to the program is the surveillance done in the summer months. Guidelines are presented for criteria, based on surveillance data, that would result in a move to the next higher level of surveillance and management. Arrangements for pesticide applications (to be applied if necessary, according to the protocol) are in place by the end of June, with approvals completed at that time. These arrangements include permit approval, arranging for applicators, etc. Decisions on movement to higher action levels are made by NPS staff in consultation with appropriate experts.

Level 1: Routine surveillance.

This consists of passive surveillance for dead birds as well as mosquito monitoring using CDC miniature light traps baited with carbon dioxide, and gravid traps. Traps are set once each week, July through September. Passive surveillance for dead birds includes alerting park rangers and resource management staff to be on the lookout for them. Dead birds

are collected using appropriate protocols and sent for EEE and WNV testing. Substantial mosquito trap catches results in a move to Level 2.

Level 2: Intensified surveillance. This includes continued surveillance for dead birds, as well as monitoring of adult mosquitoes using traps as described in Level 1. In addition, mosquitoes are tested for WNV and EEE virus, and densities of larval mosquitoes are monitored. The national seashore begins the season at Level 2 due to the high expectation of virus in the New York area. Evidence from larval samples of a potential emergence of adult mosquitoes results in a move to Level 3.

Level 3: Public notification. NPS notifies Suffolk County Vector Control of the results of the surveillance program. In case of detection of WNV or EEE, visitors to the park are also notified about mosquito densities, possibility of infection, and self-protection methods to minimize the number of mosquito bites. Arrangements are finalized for pesticide application in case conditions warrant such intervention (coordinated with Suffolk County Vector Control). Consultation is initiated between the park and Suffolk County Vector Control, New York State Health Department, CDC, U.S. Department of the Interior, and experts from universities or other institutions to guide the park superintendent on potential courses of action.

Level 4: Mosquito management. This is the highest step and the only one under which NPS actu-

ally manages mosquitoes. The approach to mosquito management will depend on the nature of the disease risk, as projected from the surveillance data. EEE activity must be detected by cell culture, or by another suitably rigorous technique approved by national seashore staff, before mosquito management is initiated in the park. Detection methods for WNV are based on CDC recommendations and approved by national seashore staff. Specific actions to be taken are described in the plan, according to epidemic factor and the type of disease present.

Actions could include aerial application of adulticide (such as resmethrin, malathion, or another material approved by NPS) to park lands. Any pesticide would be applied to the site of viral identification and to the barrier island for approximately five miles in both directions from the identification site(s), stopping at appropriate natural borders. Multiple viral isolations could result in more extensive adulticide application, determined by the consultation process, and based on specifics of viral spread.

Results

The summer of 2000 marks the third full year of the program. Results have been positive and encouraging. Tens of thousands of mosquitoes have been collected and tested from throughout the national seashore. When WNV broke out in late summer 1999, NPS was cited as an example of a proactive example of

responsible public health management. In anticipation of the 2000 season, the national seashore coordinated a meeting with Gateway National Recreation Area and Sagamore Hill National Historic Site to assist them in beginning mosquito programs and developing a coordinated NPS response that would be consistent throughout the New York area. Despite the recurrence of WNV in 2000, the national seashore has not been the subject of a single editorial or congressional meeting. In fact, residents and community leaders on Fire Island are now in the habit of calling NPS for reference and information. The credibility of NPS has increased to the point where we are now considered a reliable source of factual information.

Conclusions

WNV is spreading throughout the USA. This year it has been found in New England, and parks there are responding. Few experts deny that we are bound to see other new viruses arise in North America transmitted from around the globe. In order for parks to protect their resources and ensure public safety, the experience here at Fire Island National Seashore can lend some guidance:

- Σ It must be continually reinforced to the public that their safety is a paramount concern.
- Σ We must be sympathetic to the nuisance issue and help the public respond.
- Σ Good science is essential if in-

formation coming from the park is to be credible.

- Σ Having a plan in place before it is needed is the best means of protecting resources against unwarranted damage.
- Σ Working partners that the public considers to be credible and respected, such as CDC and local agencies, gives NPS credibility in its actions.
- Σ Public information is essential. Managers of the affected area must be approachable, available, and knowledgeable on the issues. This cannot be relegated to lower-level staff alone. To maintain credibility with the public, the park manager must be seen as visible and aware of the issue and responsive to public concerns.
- Σ All park employees must participate in the planning and execution of the program so that they are not only ready with information for the public, but that their own concerns for the safety of themselves and their families are addressed.

Our experiences in dealing with mosquitoes at Fire Island National Seashore have demonstrated that the way to protect natural resources and public health is to target efforts carefully and specifically. Identifying the specific issue or threat, addressing that issue, and focusing on its solution go a long way toward eliminating the unwanted side effects and unneeded actions that can damage critical resources and, possibly, public health. Credible science coupled

with demonstrable management reactionary responses that, in the
measures and public information can long run, are not in the best interests
enable NPS to withstand and counter of either people or resources.

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