2011 MOSQUITO SURVEILLANCE AND MANAGEMENT PROTOCOL

FIRE ISLAND NATIONAL SEASHORE

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The purpose of this plan is to present a surveillance protocol to monitor mosquito populations from Fire Island National Seashore (FIIS) and to test mosquitoes for evidence of arboviral infection. Surveillance efforts focus on possible mosquito infection with Eastern Equine Encephalitis virus (EEE) and West Nile Virus (WNV) (See 2011 Mosquitoes Action Plan). **Fire Island National Seashore will carry out a sanitation program to reduce artificial *Culex* larval habitat on lands administered by the national seashore, and will institute this surveillance and management protocol to minimize any risk of viral transmission.** The plan outlines appropriate additional actions if data indicate increasing risk of mosquito-borne disease.

The need for responses based on unpredictable trends in the spread of viruses requires that a consultation process be established that will allow appropriate responses to changes in mosquito populations and viral infection patterns as they occur. This consultation will include National Park Service (NPS), other Dept. of Interior (DOI), Center for Disease Control and Prevention (CDC), NY State, Suffolk County, and local experts.

Criteria for active management within the park:

Presence of WNV in or near the park, or of EEE in the park, or extraordinarily persistent and/or high levels of EEE infection in mosquitoes near the park, could trigger interventions within the park if conditions are such that:

1) the conditions strongly suggest disease risk to humans;
2) the risk of disease transmission would be substantially lowered by the intervention; and
3) mosquito management within the park is superior to other available approaches to manage disease risk.

The decision to apply mosquito management interventions will depend on the intensity and persistence of viral activity, proximity of viral activity to mosquito emergence sites within Fire Island National Seashore, time of year, mosquito population levels, etc. Because these conditions vary from year to year, and cannot be predicted, this consultation process will be used to determine whether interventions within the park are warranted on a case by case basis.

Interventions can include closing portions of the park to the public, mosquito management methods such as applications of *Bacillus thuringiensis israelensis* (*Bti*), *Bacillus sphaericus* (*Bs*), or methoprene to prevent emergences, or adulticide applications to areas with high levels of adult *Culex* spp.or *Aedes sollicitans*. The final decision on all management interventions within Fire Island National Seashore, including the William Floyd Estate, will be made by the Park Superintendent in accordance with NPS Management Policies.

Specific criteria for level of surveillance and management:

Three levels of action are proposed: (1) Surveillance and Education, (2) Detection and Public Notification, and (3) Mosquito Management. Based on monitoring data, guidelines are presented for deciding what criteria would result in a move to the next higher level of surveillance and management. Arrangements to send mosquitoes for viral testing should be completed by the end of June at the latest. Similarly, arrangements for pesticide applications or other management interventions (to be applied if necessary, according to this protocol) should be completed by the end of June. These arrangements will include permit approval, arranging for applicators, etc. Decisions to move to higher levels will be made by park staff, in consultation with appropriate experts.

Level (1) - Surveillance and Education

Education consists of park brochures, interpretive programs, etc., to inform the public about mosquitoes, their roles in natural systems, potential disease transmission, and associated surveillance and management programs. Basic surveillance consists of passive surveillance for dead birds, mosquito monitoring, especially adult monitoring using CO_2-baited CDC miniature light traps and gravid traps, and viral testing.

The gravid traps are intended to sample gravid *Culex* spp., and to be sensitive indicators of the presence of WNV. The CDC traps are intended to sample host-seeking female mosquitoes of several species (including *Ae. sollicitans* and *Culex* spp.) to provide broader surveillance of viral infection in potentially human-biting mosquitoes. Therefore, gravid traps will be placed in or near potential *Culex* larval habitat, and CDC traps will be placed at sites where mosquitoes are likely to encounter humans, or between mosquito production sites and potential human-encounter sites. Guidance for trap placement will be obtained from the report "Distribution and dispersal of mosquitoes, Fire Island National Seashore" (H.S. Ginsberg & F.J. Rohlf. 1985. Report #OSS-86-1, National Park Service, Boston, MA) and by consultation with mosquito biologists.

In 2011 mosquito surveillance will begin with a total of eighteen traps (10 light traps and 8 gravid traps). Most traps will be placed in pairs, with one Carbon dioxide (CO_2)-baited CDC light trap paired with one gravid trap at each trap site. Individual trap placement will depend on local habitat distribution (the gravid trap will generally not be directly adjacent to the paired CDC trap).

On Fire Island a total of fourteen traps will be placed from west to east. The traps are located as follows: one gravid/CDC trap pair will be placed near wetlands at the eastern end of the Lighthouse tract. One gravid/CDC trap pair will be located in Saltaire. The Saltaire gravid trap will be located on West Walk while the CDC light trap will be located on Neptune Walk. One gravid/CDC trap pair will be placed in the Sunken Forest along the board walk and one single CDC light trap will be place behind the concession stand. One gravid/CDC trap pair will be placed in the Carrington Tract just west of Fire Island Pines. At Watch Hill, a gravid and CDC light trap will be placed near the Watch Hill / Davis Park border along with a single CDC

light trap located near the park employee housing. Just west of the Wilderness Visitor Center at Smith Point one gravid/CDC trap pair will be placed behind the primary dune.

At the William Floyd Estate (WFE) a total of four traps will be set. One gravid/CDC trap pair will be placed in moist woodland habitat near the salt marsh/woods border. One CDC light trap and one gravid trap will be placed near the freshwater wetland drainage near the main entrance.

This initial distribution of traps may be modified based on surveillance results. For example, if there are positive results in birds or mosquitoes in an area, additional traps can be added to this area to get more complete information about the local epizootiology of the virus.

Traps will be set once each week, June – September (traps at different sites may be placed on different nights to facilitate timely setting and collecting of traps). Trap catches will be sorted to species, and the number of *Culex* spp., *Aedes sollicitans, Ae. taeniorhynchgus, Ae. vexans* -- and other mosquito species as time permits -- will be counted. During large emergences, trap counts and species composition will be estimated using appropriate techniques.

Virus testing: Mosquitoes captured in the surveillance traps will be sorted to species and placed in pools using appropriate techniques. A pool will consist of up to 50 mosquitoes of a single species from a single trap (pool size is recommended by testing lab). Pools of *Culex* spp. (especially *Cx. pipiens* and *Cx. salinarius*) will be sent for viral testing by cell culture, PCR, or other technique approved by Park staff. Pools of *Ae. sollicitans, Ae. vexans*, or other species can also be sent to the laboratory for detection of WNV and EEE virus. Pools of additional species can be sent for testing at the discretion of Park staff.

Larval Monitoring: Mosquito larvae will be monitored using a pint dipper. Sampling sites will be selected by reference to Ginsberg & Rohlf (1985) and/or by consultation with mosquito biologists, and modified by current experience. At least 25 dips will be taken at each site, the larvae counted, and representative specimens returned to the lab to confirm identifications (see Ginsberg & Rohlf 1985), as time permits. Larvae can be sampled as needed based on consultation with Suffolk County and mosquito experts. Should a virus be found in FIIS, larvae will be sampled as often as recommended by mosquito experts.

Dead Birds: Passive monitoring for dead birds will include alerting park rangers, interpreters, and resource management staff to be on the lookout for dead birds. Reports of bird mortality will be investigated by resource management staff, and candidates for possible viral infection will be collected and submitted for testing using a protocol developed by the park in accordance with guidelines from the U.S. Fish and Wildlife Service, the CDC, NYS and the Suffolk County Health Department.

Criteria for move to Level (2):

Substantial mosquito trap catches will result in a move to Level (2). The term "substantial" is defined as a catch of over 1,000 female mosquitoes in a CO_2-baited CDC light trap from Fire Island, or of over 100 individuals in a trap on the William Floyd Estate. Also, detection of WNV

or EEE virus in birds, mammals, or mammal-feeding mosquitoes on Fire Island or at mainland Long Island sites within five miles of Fire Island or of the William Floyd Estate will trigger an increase to Level (2) surveillance. Detection of EEE virus in bird-feeding mosquitoes (e.g., *Cs. melanura*) will trigger a move to Level (2) if there are signs of higher than normal prevalence (e.g., at least three pools of *Cs. melanura* positive for EEE within five miles of Smith Point or of the William Floyd Estate).

Level (2) - Detection and Public Notification

The park will notify Suffolk County Vector Control of the results of the surveillance program. If WNV or EEE is detected within the park, visitors to the park will also be notified about mosquito densities, possibility of viral infection (realistic assessment), and self-protection methods they can use to minimize the number of mosquito bites. Arrangements will be finalized for pesticide application in case conditions warrant such intervention (this should be coordinated with Suffolk County Vector Control). Consultation will be initiated between Fire Island National Seashore and Suffolk County Vector Control, NYS Health Department, CDC, DOI, and/or experts from universities or other institutions to guide the Park Superintendent on potential courses of action. Larval management in artificial sites will be intensified and surveillance will continue.

Criteria for move to Level (3):

Detection of WNV in a potential human biter (e.g., *Culex spp.*, *Ae. sollicitans,* or *Ae. vexans*), or of EEE in a potential epidemic vector (e.g., *Ae. sollicitans, Coquillettidia perturbans, Ae. vexans*) in the park will trigger the consultation process to assess the risk of disease transmission. In general, single positive mosquito pools will result in intensified surveillance (increased trapping and larval sampling), and multiple positive pools will result in an increase to level (3). Signs of increasing WNV epizootic activity (e.g., positive birds followed by positive mosquito pools, or multiple and increasing numbers of positive birds over a two-week period) can result in an increase to level (3), based on the consultation process. Detection of WNV or EEE in potential epidemic vectors outside but near the park, persistent high levels of EEE in *Cs. melanura* at sites within 5 miles of the park (at least three EEE isolations at a site in consecutive samples taken within one month) at the same time as evidence of an imminent emergence of *Ae. sollicitans*, or other evidence of EEE activity (e.g., animal cases) within 5 miles of the park will trigger the consultation process to assess the risk of disease transmission. The consultation can result in an increase to Level (3) if such action is deemed appropriate by the Park Superintendent after consultation with the appropriate experts and in accordance with NPS Management Policies.

Level (3) - Mosquito Management

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 followed by virus characterization, or by other suitably rigorous techniques approved by park staff, before mosquito management is initiated in the park. Detection methods for WNV will be based on CDC recommendations and approved by park staff.

(3a) Epidemic vector infected with EEE in Fire Island National Seashore

i. EEE detected in *Ae. sollicitans* (or other potential epidemic vector) on Fire Island.

Intervention: Application of adulticide (resmethrin, permethrin, or other material approved by park staff) to Fire Island, if appropriate according to consultation process. Pesticide will be applied to the site of viral identification and to the barrier island for distances in both directions from the identification site(s) determined by the consultation process, and stopping at appropriate natural borders. Multiple viral isolations can result in more extensive adulticide application, determined by the consultation process, based on specifics of viral spread. Similarly, single isolations at remote sites can result in less extensive, finely-targeted application(s). Larviciding can occur in natural areas with high larval densities of potential vector species.

ii. EEE detected in *Ae. sollicitans* (or other potential epidemic vector) at the William Floyd Estate.

Intervention: Application of adulticide to the William Floyd Estate, if appropriate according to consultation process.

iii. Potential human vector mosquito species positive for WNV in an area with previously-demonstrated epizootic activity (previous positive mosquito pools or multiple positive vertebrates)

Intervention: Based on consultation process. A single mosquito pool positive for WNV would typically result in increased trapping to assess risk of human disease. Multiple positive pools in an area with previously-demonstrated epizootic activity could result in adulticide and/or larvicide application, as in (3a) section i.

(3b) Multiple WNV or EEE detections in vertebrate(s) in Fire Island National Seashore

Intervention: Based on consultation process. Interventions can include increased mosquito trapping and testing, and increased larval management and/or adulticiding when there is evidence of intensive epizootic activity (e.g., numerous or increasing numbers of positive birds within a two-week period, or positive birds coupled with positive mosquito pools), especially when accompanied by high mosquito numbers (e.g., *Culex* in CO_2 CDC trap catch > 500 females/trap; *Ae. sollicitans* in carbon dioxide-baited CDC trap catch > 2,500 females/trap).

(3c) WNV or EEE detected outside but near the park, or in enzootic vectors within the park, with current or imminent emergence of epidemic vector species within the park.

i. WNV: Multiple evidence of WNV in mosquitoes or vertebrates within two miles of Fire Island National Seashore can trigger adulticide application within the park if populations of *Culex* spp. are high (trap catches >500 females in CO_2 baited CDC light trap on Fire Island, >50 females in CDC trap at WFE) or if populations of *Ae. sollicitans* are high (trap catches >2,500 females in CDC trap on Fire Island, >250 females in CDC trap at WFE) in park areas within two miles of the viral isolations. Treatment would be permitted at lower trap catch levels, based on the consultation process, if mosquito populations included numerous older individuals. Location and extent of application will be based on consultation process. Response at lower adult densities, with evidence of imminent emergence from larval samples, will be based on the consultation process and can include larval management.

ii. EEE: Evidence of EEE within 5 miles of Fire Island National Seashore, or in *Cs. melanura* within the park, will trigger the consultation process. Park staff will contact the CDC (initially by phone, FAX, or e-mail, with more comprehensive consultation only if necessary), NY State, Suffolk County, DOI, university, and/or other experts as needed. If conditions warrant (according to the CDC and/or in consultation with other appropriate experts, to lower the risk of human disease) appropriate interventions can be applied in accordance with NPS Management Policies.

Consultation with:
Howard S. Ginsberg, Ph.D.
USGS Patuxent Wildlife Research Center, 2010