Report
Mosquito And Predator Sampling Shaker Trace And
Clear Creek Newtown, Ohio During 1996.
Dr. Bruce A. Steinly

During June, 1996, traps that utilized light and carbon dioxide were used to trap mosquito adults. Adult mosquitoes were removed from traps and transported to the laboratory. The number of traps was limited to two per night at each site (2 traps held in reserve to replace damaged and/or stolen traps). No traps were lost or damaged during the investigation. Adult mosquitoes were counted and prepared for identification.

During June, wetland habitats of Shaker Trace Park were in flood. Although there was a persistent rainfall pattern (through July 31, 1996), the water level within the newest wetland (south of Baughman Road) at Shaker Trace decreased. Although the newly restored wetland contained little water on July 26, 1996 (a small pool below the wood-duck box), the wet woodland north of the wetland and south of Baughman Road harbored persistent pools. These pools were positive for mosquito larvae. Although the newest wetland dryed completely, the locality is probably a significant oviposition site (i.e. egg deposition site) that will be utilized by floodwater mosquitoes in the future. At Shaker Trace, Aedes vexans, a floodwater mosquito, was a significant part of the mosquito community. As floodplain dry and mature, Aedes vexans can be expected to lay eggs within these habitats. Furthermore, considerable macrophyte cover developed during late summer in the dry basin. Decaying vegetation mats and emergent plant material (above the water's surface) may augment existing Ae. vexans and Ae. trivittatus larval habitat next season (1997). These two mosquitoes that were abundant in the carbon dioxide-light traps are not known vectors of disease, but are serious biting pests. Additionally, the newer wetland contained several potholes on the south end and may contribute to increased mosquito abundance in the future. These potholes, relatively small circular depressions, held water while the majority of the adjacent wetlands was dry. The potholes did not have a diverse community of invertebrate predators or populations of mosquito larvae. The pothole habitats were sheltered from wind by stands of Typha latifolia (cattail) that decreased wave action and evaporation. The relative stability of potholes suggests that available mosquito breeding habitats (i.e.

potholes) may be colonized in the future. Extensive use of praire potholes by mosquitoes has been well documented in the literature.

No Ae. vexans and Ae. trivittatus larvae were collected within the mature wetlands north of Baughman Road. More than 800 dip samples yielded a few Coquillettidia perturbans larvae and Culex pipiens larvae. Low numbers of mosquito larvae collected in dip samples suggests that predator (insect and vertebrate) populations may be suppressing larval populations of mosquitoes in wetlands. Experimental evidence (Steinly unpublished) confirmed that Culex pipiens and Aedes vexans larvae are consumed by whirligig beetles. Both mosquito species were collected at Shaker Trace and Newtown. Mature wetlands at Shaker Trace had large populations of Gyrinus analis i.e. a whirligig beetles species cruising the surface. Individual whirligig specimens were observed and collected from open water and sheltered habitats (cattail and emergent vascular vegetation).

Additionally, dragonfly communities were well developed in the older three wetlands. In all probability, dragonfly immatures account for a portion of mosquito mortality (larval). Adult dragonfly populations will have a negligible negative effect on the adult mosquitoes populations because dragonflies hunt during the day while mosquito adults will be most active at dusk and dawn. The immatures of most invertebrate predators (including whirligigs and dragonflies) require permanent aquatic habitats to complete development. The newest wetland does not seem to hold water long enough to sustain the development of diverse invertebrate predator communities.

Late in the season, water levels dropped in wetlands north of Baughman Road. As the water receded, shaded pools of water formed within a tree grove that was normally inundated. These pools contained Culex pipiens larvae. In the past, this species has been associated with the spread of St. Louis Encephalitis in Ohio. I suggest that late seasonal development of this mosquito habitat (north of Baughman Road) does not present a problem, but future pool formation during years of early drought may augment the Culex pipiens population and increase the possibility of disease transmission. Culex pipiens eggs hatch and larvae develop in sheltered pools that have high concentrations of decaying organics. In open water, wind increases the water's surface turbulence and is a possible cause of Culex pipiens mortality.

During late May, mosquito larvae i.e. Cx. pipiens and Cx. restuans were

collected (dip samples) from the wet meadow east of the newly constructed wetland and ditches along Baughman Road. Also, larval collections detected abundant mosquito populations i.e. Aedes sp. in a depression under the treeline that was west of the mature Baughman Road wetland (north of Baughman Road). The treeline ditch site was dry on July 17, 1996 and did not contributed to the mosquito population abundance through September 30, 1996. Only 12 dip samples of 800 total samples from the three oldest wetlands were positive for mosquito larvae (May through September 20, inclusive). The number of larvae within these samples ranged from 2 to 12 larvae (50 and 100+ are considered moderate and high). The low abundance of mosquito larvae suggests that the mature wetlands (three oldest) are not contributing significantly to mosquito densities during the spring and summer months. Furthermore, the abundance (number of species and individuals within each species category) of vertebrate and invertebrate predators within mature wetlands may constitute a significant biological control of mosquito larval populations. Relatively large populations of predaceous diving beetles, back-swimmers, water boatman, whirligig beetles, and dragon and damsel flies were observed and sampled. Individuals have been collected and will be identified in the future. Predator collection continued throughout the summer and fall months. A few damsel and dragonflies were collected in the newly reconstituted wetland south of Baughman Road and probably are immigrant that developed in relatively permanent wetlands to the north.

More than 5,000 mosquitoes were collected at the Shaker Trace and Newtown localities (Table 1). Maximum abundance of most mosquito species occurred during mid August and was followed by a gradual decline. Shaker Trace trap samples contained 16 species that include Anopheles earlei Vargas, Anopheles punctipennis (Say), Anopheles quadrimaculatus Say, Aedes cinereus Meigen, Aedes excrucians (Walker), Aedes fitchii (Felt and Young), Aedes sticticus (Meigen), Aedes triseriatus (Say), Aedes trivittatus (Coquillett), Aedes vexans (Meigen), Coquillettida perturbans (Walker), Culex erraticus (Dyar and Knab), Culex restuans Theobald, Culex pipiens Linnaeus, Culex salinarius Coquillett, and Psorophora cyanescens (Coquillett) (Table 4-6). The abundances of individual species are reported in Tables 4-6. Ae. trivittatus, Ae. vexans, and Coquillettida perturbans were the most abundant species within the Shaker Trace collections throughout the season. The total number of adult specimens collected at the

Shaker Trace and Newtown sites are included in the Table 1 and 2. Adult sampling initiated in the Oxford area provided a baseline of mosquito activity (Table 3). The samples from the Oxford area contained large numbers of Ae. triseriatus, Ae. vexans, and Ae. trivittatus. Ae. triseriatus (treehole breeding mosquito) was collected most often in the vicinity of Oxford, but it's abundance was low in Shaker Trace and Newtown collections.

During the spring and early summer, the intensity of adult mosquito biting was remarkably high in southern Ohio. During August, the increase of mosquito adult abundance near the Oxford, Newtown, and at Shaker Trace Park suggests that increased mosquito abundance was widespread. Anecdotal evidence (reports in the media) supports this conclusion. In late September, I experienced intense biting at Shaker Trace while setting traps south of Baughman Road. While the daytime temperatures were in the high 50s, night-time temperatures around 30° F eliminated mosquito flight activity. Even though daytime adult mosquito populations were high, no specimens were collected with light-carbon dioxide traps on this occasions.

The Clear Creek sites yielded Anopheles barberi Coquillett, Anopheles punctipennis (Say), Anopheles quadrimaculatus Say, Aedes triseriatus (Say), Aedes trivittatus (Coquillett), Aedes vexans (Meigen), Culex erraticus (Dyar and Knab), Culex pipiens Linnaeus, and Culex salinarius Coquillett (Table 5-9). Attempts to collect larvae from the oxbow were unsuccessful (approximately 100 dip samples on 3 occasions = 300 dip samples total). Most ephemeral surface water dryed-up during early summer. The persistent increase of mosquito abundance during August suggests that larval habitat in or near Newtown has not been discovered or some of individuals may be immigrants. The ability of Ae. vexans to fly great distances has been well documented. Additionally, this species has an affinity for light. Certainly, a portion of the adult population probably developed in local ephemeral habitats during the spring and early summer months and contributed to the biting problem.

Collections of invertebrate predators from the Shaker Trace localities included Gyrinus analis (whirligig beetles), Notonecta americanus, Ochthera mantis, Ochthera borealis, Anax junius, Gerris sp., Corixa sp., Agrion sp. and Libellula sp. Interestingly, most of the species in these genera are predaceous throughout their life cycles. Immature stages of these predators were frequently collected in aquatic environments.

Conclusions:

I do not believe that the abundance of disease carrying mosquitoes is a significant problem (may be a problem in the future). The abundance of Cx. pipiens and Ae. triseriatus, the vectors of St. Louis Encephalitis and La Crosse Encephalitis, respectively, were low. The numbers of Anopheles sp. (vector of Malaria) were low, but will require watching. Although Coquillettidia perturbans has been associated with Eastern Equine Encephalitis (EEE), the presence of Culiseta melanura (Coquillett) is required for the cycling of the disease (no specimens collected at Clear Creek or Shaker Trace). Even though the region experienced higher than normal precipitation levels last spring, the wetlands north of Baughman Road are not a significant source of mosquitoes. Invertebrate and vertebrate predator were abundant and many species consume mosquito larvae. The intensity of biting and abundance of mosquitoes in close proximity to the newest wetland (south of Baughman Road) suggests that the area sustained significant populations of mosquito larvae during the spring and early summer months. This has not been confirmed. Dip sampling would confirm the presence of larval populations within the wetland and should be completed before any control measures are instituted.

Recommendations:

At Clear Creek, I recommend doing nothing until construction activity has been completed. After the underground pipeline in completed, areas that settle should be filled. Where filling depressions may be impractical (cost considerations), drainage may be improved so low areas hold water for less than a week. At the height of the season, some mosquito species can complete development in 7-10 days. Where the above is not possible, the application of a microbial pesticide may be logistically practical and cost effective. Commercial microbial pesticides that selectively kill mosquitoes only may be applied to breeding sites. These sites require identification and mapping before the microbial pesticide is applied. Maps of permant and ephemeral mosquito habitat provide locality information that facilitates continuous site monitoring. In short, personnel will be able to locate sites without continous supervision.

Additionally, individuals in the surrounding communities of New Haven and Newtown are using commercial "bug zappers". In all probability, these "bug zappers" attract mosquitoes that are in search of a blood meal. Once a mosquito acquires a blood meal, the search for suitable oviposition sites is initiated. In general, I do not believe that "Bug Zappers" significantly reduce adult mosquito populations or the frequency of biting. Manufactures have not informed the public concerning product limitations. There is a need for more public education concerning the undesirable effects of "bug zapper" lights.

I suggest that mosquito populations be studied for at least another year. Larval collections in addition to light-carbon dioxide trapping may clearly delineate the magnitude of any mosquito problem at Shaker Trace during a year of "normal" precipitation. During the spring of 1996, the frequency, intensity, and duration of precipitation were unusually high. Precipitation and temperature patterns may have contributed to the widespread increase of mosquito populations in southwestern Ohio. I wonder, what mosquito abundance levels would be like in a "normal" year? Further studies at Clear Creek would be beneficial after construction activity is discontinued. Although trap data suggests that floodwater mosquitoes are the major portion of the pest mosquito community, the sources of these populations requires confirmation. Once the sources (short term and long term) are identified, viable solution(s) may be discussed.

The newest wetland and the adjacent wet woods at Shaker Trace are the probable sources of floodwater mosquitoes. In all probability, floodwater mosquito species that utilize areas that flood rapidly will continue to be a problem as greater amounts of debris accumulated in the wetland's basin. This is a very large area to treat with microbial insecticide (costly product and labor intensive). I do suggest that the limited utilization of microbial insecticide may be practical. If there are a limited number of locations in the wetland and/or wet woods that are harboring a major portion of the larval mosquito population, spots applications of microbial pesticides within the wetland may have a beneficial effect and be cost effective. A feasibility study would be required. During the last decade, limited spot applications of microbial pesticide have been used by mosquito abatement districts in the midwest. These mosquito districts have been exhaustively mapped. Maps

include location of permanent and ephemeral mosquito habitat and the duration of water retention. While supervising personnel at one of these districts, I observed that limited spot application of microbial pesticide was cost effective and had no measurable effect on non-target organisms.

Table 1.

Contents of Adult Mosquito Samples in 1996
Shaker Trace Park, OH.

Miami Whitewater Park

Date	Site 1	Site 2		Total/ Night	Mean/ Trap
June 20	38	37	=	75	37.5
July 11	21	63	=	84	42.0
August 1	239	514	=	753	376.5
August 14	441	1040	=	1481	740.5
August 28	214	644	=	858	429.0
September 11	105	388	=	493	246.5
Total/site =	1058	2686	=	3744	

Table 2.

Contents of Adult Mosquito Samples in 1996
Clear Creek Newtown, OH.

Newtown, Ohio Sites

Date	1	2			
July 12	59	193	=	252	126.0
August 9	242	333	=	575	287.5
August 23	133	476	=	609	304.5
August 29	22	41	=	63	31.5
September 20	9	18	=	27	13.5
Total/site=	465	1061	=	1526	

Total Newtown & Shaker Trace = 1526 + 3744 = 5270

Table 3.
Contents of Adult Mosquito Samples in 1996
Oxford, Ohio

Date		ERC	Gregg Farm		
August	9	75	136	=	211
August	22	53	59	=	112
September	6	32	21	=	53
	Total =	160	216		376

Table 4.
Abundance of Mosquito Species At Shaker Trace Park During 1996

Collection Dates: VI-20-1996 VII-11-1996

Species	Number of Individuals Collected				
	1	2	1	2	
Coquillettidia perturbans (Walker)	20	18	10	7 =	55
Culex erraticus (Dyar and Knab)	3	1		1 =	5
Culex pipiens Linnaeus		1	2	=	3
Culex restuans Theobald	7	6		=	13
Culex salinarius Coquillett				1 =	1
Aedes cinereus Meigen					
Aedes excrucians (Walker)					
Aedes fitchii (Felt & Young)					
Aedes sticticus (Meigen)					
Aedes triseriatus (Say)					
Aedes trivittatus (Coquillett)	2	2	6	3 =	13
Aedes vexans (Meigen)	3	2	36	6 =	47
Anopheles barberi Coquillett					
Anopheles earlei Vargas				1 =	1
Anopheles punctipennis (Say)	1		1	=	2
Anopheles quadrimaculatus Say			4	2 =	6
Psorophora cyanescens (Coquillett)					
Total =	36	30	59	21	

Table 5.
Abundance of Mosquito Species At Shaker Trace Park During 1996

Collection Dates: VIII-1-1996 VIII-14-1996

Species	Number of Individuals Collected				
	1	2	1	2	
Coquillettidia perturbans (Walker)	27	11	48	24	= 110
Culex erraticus (Dyar and Knab)	8	1	16	5	= 30
Culex pipiens Linnaeus	14	3	8		= 27
Culex restuans Theobald					
Culex salinarius Coquillett					
Aedes cinereus Meigen					
Aedes excrucians (Walker)		3			= 3
Aedes fitchii (Felt & Young)		1			= 1
Aedes sticticus (Meigen)	8				= 8
Aedes triseriatus (Say)	19		9		= 28
Aedes trivittatus (Coquillett)	390	186	255	939	= 1770
Aedes vexans (Meigen)	47	34	97	60	= 238
Anopheles barberi Coquillett					
Anopheles earlei Vargas					
Anopheles punctipennis (Say)	1				= 1
Anopheles quadrimaculatus Say					
Psorophora cyanescens (Coquillett)					
Total =	514	239	433	1030	

Table 6.
Abundance of Mosquito Species At Shaker Trace Park During 1996

Collection Dates: VIII-28-1996 IX-11-1996

Species	Number of Individuals Collected			
	1	2	1	2
Coquillettidia perturbans (Walker)	18	11	10	1 = 40
Culex erraticus (Dyar and Knab)	28	8	29	4 = 69
Culex pipiens Linnaeus	8	3	15	59 = 85
Culex restuans Theobald				
Culex salinarius Coquillett			2	1 = 3
Aedes cinereus Meigen			2	= 2
Aedes excrucians (Walker)				
Aedes fitchii (Felt & Young)				
Aedes sticticus (Meigen)			12	2 = 14
Aedes triseriatus (Say)		2		9 = 11
Aedes trivittatus (Coquillett)	136	572	247	8 = 963
Aedes vexans (Meigen)	15	41	60	17 = 133
Anopheles barberi Coquillett				
Anopheles earlei Vargas				
Anopheles punctipennis (Say)				1 = 1
Anopheles quadrimaculatus Say	2	1	13	1 = 17
Psorophora cyanescens (Coquillett)		6		2 = 8
Total =	207	644	390	105

Table 7.
Abundance of Mosquito Species At Clear Creek Newtown During 1996

Collection Dates:	VII-12-1996		VIII-09-1996		
	Number of Individuals Collected				
Species	1	2	1	2	
Coquillettidia perturbans (Walker)					
Culex erraticus (Dyar and Knab)			1		= 1
Culex pipiens Linnaeus	12	6	21	17	= 56
Culex restuans Theobald					
Culex salinarius Coquillett					
Aedes cinereus Meigen					
Aedes excrucians (Walker)					
Aedes fitchii (Felt & Young)					
Aedes sticticus (Meigen)					
Aedes triseriatus (Say)	7	2	6		= 15
Aedes trivittatus (Coquillett)	164	35	287	201	= 687
Aedes vexans (Meigen)	9	14	10	18	= 51
Anopheles barberi Coquillett					
Anopheles earlei Vargas					
Anopheles punctipennis (Say)	1	1			= 2
Anopheles quadrimaculatus Say		1		1	= 2
Psorophora cyanescens (Coquillett)					
Total =	193	59	325	237	

Table 8.
Abundance of Mosquito Species At Clear Creek Newtown During 1996

Collection Dates:	VIII-23-1996		IX-7-1996		
	Number of Individuals Collected				
Species	1	2	1	2	
Coquillettidia perturbans (Walker)					
Culex erraticus (Dyar and Knab)	19		5	7	= 31
Culex pipiens Linnaeus	73	15	12	4	= 104
Culex restuans Theobald					
Culex salinarius Coquillett		5		1	= 6
Aedes cinereus Meigen					
Aedes excrucians (Walker)					
Aedes fitchii (Felt & Young)					
Aedes sticticus (Meigen)					
Aedes triseriatus (Say)	27	3	4	3	= 37
Aedes trivittatus (Coquillett)	316	104	19	7	= 446
Aedes vexans (Meigen)	40	6	1		= 47
Anopheles barberi Coquillett					
Anopheles earlei Vargas					
Anopheles punctipennis (Say)					
Anopheles quadrimaculatus Say					
Psorophora cyanescens (Coquillett)					
Total =	475	133	41	22	

Table 9.
Abundance of Mosquito Species At Clear Creek Newtown During 1996

Collection Dates: IX-20-1996

Species	Number of Individuals Collected 1	2	1	2		
Coquillettidia perturbans (Walker)						
Culex erraticus (Dyar and Knab)						
Culex pipiens Linnaeus	11	5			=	16
Culex restuans Theobald						
Culex salinarius Coquillett						
Aedes cinereus Meigen						
Aedes excrucians (Walker)						
Aedes fitchii (Felt & Young)						
Aedes sticticus (Meigen)						
Aedes triseriatus (Say)						
Aedes trivittatus (Coquillett)						
Aedes vexans (Meigen)	5	4			=	9
Anopheles barberi Coquillett	1				=	1
Anopheles earlei Vargas						
Anopheles punctipennis (Say)	1				=	1
Anopheles quadrimaculatus Say						
Psorophora cyanescens (Coquillett)						
Total =	18	9				

MIAMI UNIVERSITY

Department of Zoology
212 Pearson Hall
Oxford, Ohio 45056
513 529-3100
513 529-6900 FAX

John Klein
Land Manager
Hamilton County Park District
10245 Winton Road,
Cincinnati, Ohio 45231

December 3, 1996

Dear John;

If you have any questions concerning the content of the report, please feel free to call or email me. I will send you a disc converting the MAC format to IBM as requested. I will need the assistance of another faculty member; the conversion should be accomplished in a few weeks. I am leaving for the National Entomological Meetings at the end of the week and will be out of town until December 13, 1996. I have not completed to identification of invertebrate predators- hopefully, this will be accomplished by the end of Christmas Vacation. I hope that this does not inconvenience you. There was and is a lot of material to examine.

I appreciate your patience and continue to support your efforts in making Shaker Trace a great place to visit. The Shaker Trace Park is a biological treasury.

Sincerely,

Dr. Bruce A. Steinly

1996

TITLE: *Mosquito And Predator Sampling Shaker Trace and Clear Creek Newtown, Ohio During 1996.*

Dr. Bruce A. Steinly, Miami University Department of Zoology

PURPOSE: Complaints about mosquitoes near Little Miami Golf Center have been received for several years. Last year, similar complaints were expressed by neighbors to the Shaker Trace Wetland in Crosby Township. The purpose of this study was to determine the types and abundance of mosquitoes in and near the two wetlands to: (1) discover whether either or both wetlands are sources of unusual mosquito infestations, (2) find if there is a public health concern, and (3) recommend management techniques to control mosquito populations if needed.

RESULTS: Mosquito traps using light and carbon monoxide as lures were set at various locations on the following dates:

- Shaker Trace - June 20, July 11, August 1, August 14, August 28, September 11.
- Clear Creek - July 12, August 9, August 23, September 7, September 20.

Additionally, traps were monitored in Oxford, Ohio to serve as a baseline for mosquito activity for comparison. Two traps were set at each of two sites for each sampling date. The next morning the contents of each trap were counted and prepared for later identification in the laboratory. The traps were supplemented by dip-netting of the wetlands at Shaker Trace and of Clear Creek.

Samplings for both parks and Oxford showed high mosquito activity throughout southwest Ohio. Given the unusually wet spring and early summer, this was not unexpected. Four species identified as vectors of various diseases were collected. Dr. Steinly concluded their numbers were too low to pose a health problem, but he said they may require watching.

In spite of the wet season and regional abundance of mosquitoes, Dr. Steinly found the Shaker Trace Wetland north of Baughman Road was not a significant source. Out of 800 samples taken from this area, only twelve had mosquito larvae in them. This is likely due to an abundance of predators in this wetland keeping the mosquito population in check. He suspects, but has not confirmed, that the newest phase of the wetland south of Baughman sustains a significant population of mosquitoes in the spring and early summer. The reason is the hydrology. Despite the wetness of the spring and early summer, the wetland south of Baughman did not remain wet through the summer. Dr. Steinly speculates this area does not hold water long enough for a predator population to develop. Simultaneously, small potholes in this area provide a breeding ground sheltered by vegetation and is too small to support predators.

Mosquito populations in and near the Little Miami Golf Center were also high, but no mosquito larvae were found in three hundred dip-nettings of Clear Creek. As most of the ephemeral surface water dried-up during early spring, the persistence of mosquitoes through the summer suggest that all larval habitat near Clear Creek and Newtown have not been discovered or some individuals are immigrants from elsewhere. The mosquitoe's ability to fly long distances is well documented.

MANAGEMENT RECOMMENDATIONS:

1. At the Little Miami Golf Center, Dr. Steinly recommends nothing until after completion of the Metropolitan sewer District's new trunk sewer. Once completed, areas that settle should be filled. Where filling is not practical, then drainage may be improved so low areas hold water for

less than a week.

2. For both areas Dr. Steinly suggests the use of microbial pesticide (larvacide) where limited breeding pools have been identified. Due to the size of the area, a feasibility study may be needed for mosquito control at Shaker Trace Wetland south of Baughman to identify and map all of the potential breeding holes to make larvacide treatment cost-effective.

3. "Bug zappers" are in use in both the Newtown area near Clear Creek and New Haven near Shaker Trace Wetland. Dr. Steinly recommends public education to discourage their use. "Bug zappers" in fact attract mosquitoes.

4. Dr. Steinly recommends the mosquito populations at Shaker Trace Wetland be study for at least another year to better delineate the magnitude of any mosquito problem during a year of "normal" precipitation.

5. A recommendation not made by Dr. Steinly but inferred from his discussion: If the ephemeral hydrology of the Shaker Trace Wetland south of Baughman Road increases mosquito population by providing a breeding area without an adequate predator population, it follows that improving the hydrology to promote predator development will help reduce the mosquito population. Secondly, if shielding breeding pools from wind action encourages maturation of mosquito larvae, selective thinning of vegetation around identified breeding holes will also help control the mosquito population.