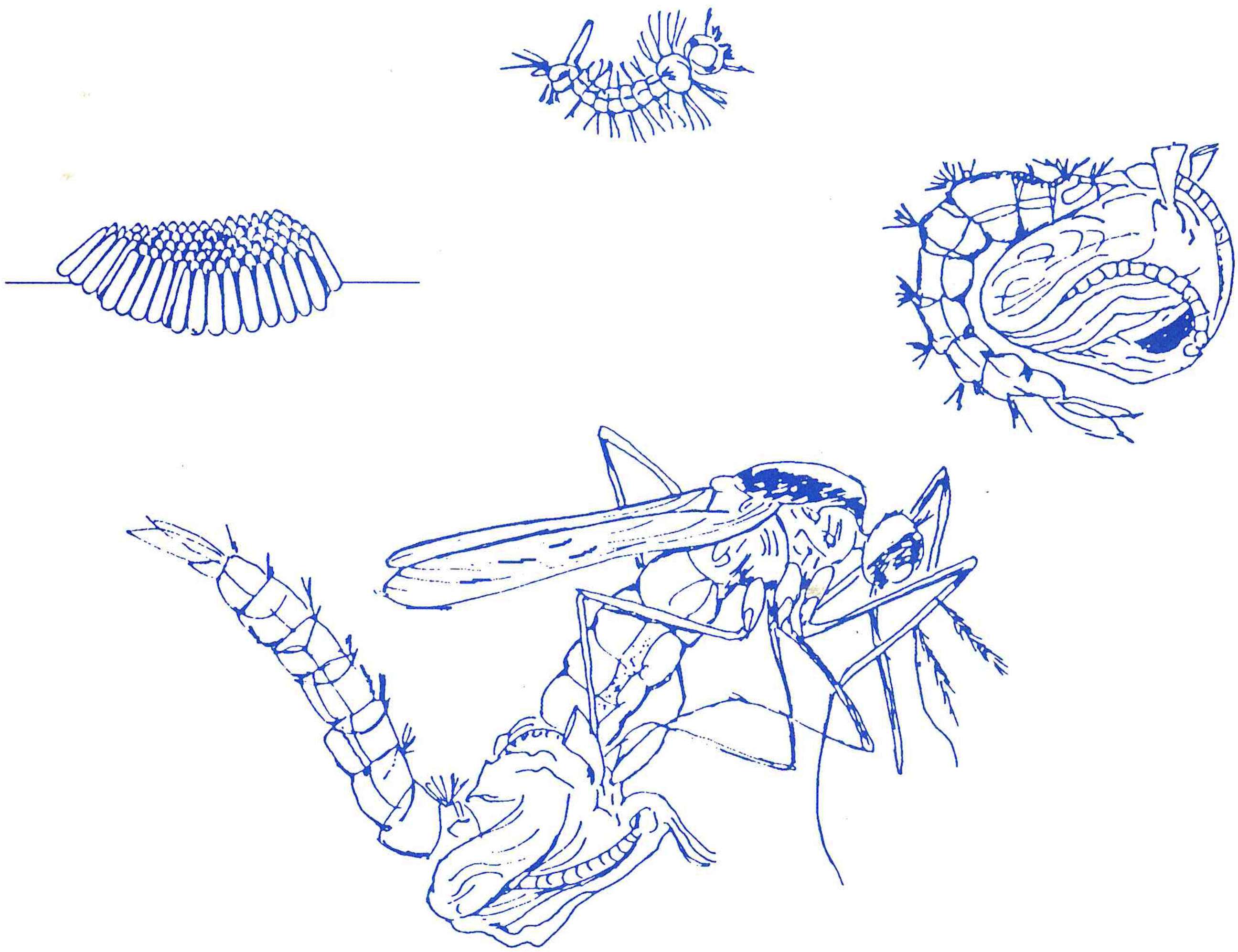
ANNUAL REPORT

1991

NOMCB

NEW ORLEANS MOSQUITO CONTROL BOARD



It is usual to speak of an animal as living in a certain physical and chemical environment, but it should always be remembered that strictly speaking we cannot say exactly where the animal ends and the environment begins.–CHARLES ELTON

Cover illustration courtesy of American Cyanamid Company.

Quote: Charles Elton
1936 *Animal Ecology.* New York: Macmillan Co., XXX + 209 pp., 13 figs., 8 pls. [6, 7, 309]

This report is dedicated to Dr. Harold Trapido (1916-1991), a member of the New Orleans Mosquito Control Board from 1982 until the time of his death. Dr. Trapido's expert knowledge of mosquito biology and control will be irreplaceable, especially as related to *Aedes aegypti*, *Aedes albopictus* and the development of DDT. A copy of his obituary by Dr. Thomas H.G. Aitken, reprinted from the Journal of the American Mosquito Control Association, appears at the end of this report.

CITY OF NEW ORLEANS

CITY OF NEW ORLEANS MOSQUITO CONTROL BOARD

ANNUAL REPORT

1991

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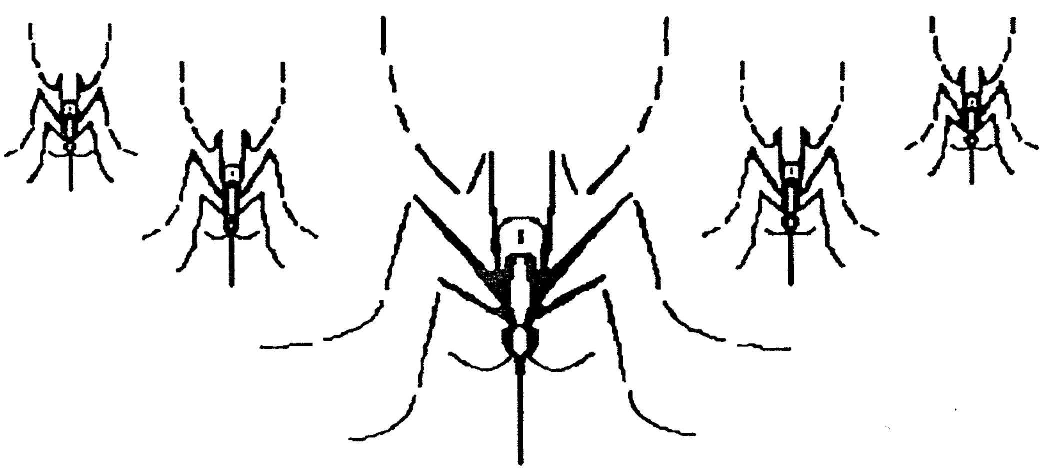

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1991 ANNUAL REPORT
NEW ORLEANS MOSQUITO CONTROL BOARD

DIRECTOR'S REPORT

EDGAR S. BORDES, JR.

There were several major events that happened at New Orleans Mosquito Control during this year, the first was having the American Mosquito Control Association Annual Meeting in New Orleans. After several years of planning and many months of hectic, harried, and just plain hard work, the AMCA annual meeting was held at the Clarion New Orleans. The event was a total success. Delegates, exhibitors and their spouses were enchanted by the charm of New Orleans and we are looking forward to hosting the AMCA annual meeting again in 1996 or 1997. The event was both a financial and a social success and it was the staff of the New Orleans Mosquito Control Board that deserves the accolades.

The second major event of the year was far less pleasant; record rainfall occurred throughout the City of New Orleans. Some areas received 140^{+} inches of precipitation and the average, overall rainfall was 109 inches. New Orleans is a very unique city because we are basically below sea level and all of this water had to be pumped out, or reserved in our impounded marsh areas. Pumped water does not affect mosquito breeding but the impounded marsh definitely influences mosquito breeding. After receiving 20 inches of precipitation in January alone, the entire area remained flooded for the balance of the year. Floodwater areas remained inundated and were not very productive; permanent water areas received so much water that the grass was flooded and the mosquito larvae could not avoid predation. Artificial containers remained flooded all year long and produced copious amounts of mosquitoes. Tidal areas also remained very productive but overall mosquito activity was normal in spite of the monsoon environment.

During 1991, water lettuce (Pistia stratiotes) was discovered in the City Park lagoons. This plant is a worldwide indicator of Anopheline mosquito breeding, and City Park does not need this additional mosquito producing capacity. Anopheles crucians, Anopheles quadrimaculatus and Culex erraticus were the most common larvae collected in the Pistia. Many minnows and predaceous insects were also collected in the water lettuce, and the presence of these natural mosquito control agents will help reduce the mosquito problem.

Aedes albopictus continues to pressure Aedes aegypti into a lesser role of importance as a container breeding pest mosquito in the City of New Orleans. There are no longer any areas in the city that are infested exclusively by Aedes aegypti, and in some areas Aedes aegypti has been completely displaced by Aedes albopictus.

Can Aedes albopictus transmit Eastern Equine Encephalitis? This is a very serious question that may be answered in the State of Florida. Because Aedes albopictus is such an aggressive blood feeder, it has the potential to bring viral encephalitis to new levels of epidemic potential in the southern United States. Encephalitis surveillance results were normal and below normal until the third week of August when 9.4% of submitted bird sera were positive for Eastern Equine Encephalitis. Adulticiding operations intensified and concentrated on the areas of positive bird bloods. No further positive bloods were reported and all control and surveillance measures returned to normal operational levels.

Aedes albopictus control is much more feasible now than it was in 1986 when this species exhibited a 10x resistance to malathion. Both modified WHO larval tests and wind tunnel tests indicate that albopictus resistance to malathion has waned and Aedes albopictus is now more susceptible than Aedes aegypti. Reduced chemical larviciding and adulticiding pressure is probably responsible in the restoration of susceptibility to the species.

Public education efforts concentrated on producing a biocontrol tape titled "COPEPODS - BIOCONTROL THAT WORKS". Copepods are called "cyclops" and are very persistent and easily renewable biocontrol agents that can be mixed with Bti and sprayed in a variety of mosquito breeding habitats. Our goal is developing and using biocontrol agents is to continue to reduce the use of chemical pesticides and still protect the citizens of New Orleans from mosquitoes. Other biocontrol agents that received some attention were planaria and larvicidal algae. Of the two, larvicidal algae seem to have the most potential for operational use.

Source reduction activities remained active primarily within the inner city with new ditch construction, ditch maintenance and cleaning clogged drains. Inspection and monitoring of existing projects takes place on a regular basis to assure that the projects are still working. The W-2 wetlands project is still on hold pending the Nature Conservancy land use plan and the acquisition of a new amphibious rotary ditcher.

After many years of anticipation and negotiation, New Orleans Mosquito Control now has a hangar for our aircraft. Hangared aircraft require significantly less maintenance than those that are tied down out-of-doors, especially when the outdoor location is adjacent to a saltwater lake. In addition to less maintenance, the life span of the aircraft is extended an additional 10 to 20 years when it is hangared. Our aviation supervisor, Mr. Al Roche, retired after ten years of service. We wish Al the b7 2of luck in his retirement years.

Buck moth caterpillars emerged on March 4th, which is several weeks after the anticipated emergence date. For the past two years the first hatch dates were February 15th for 1989 and February 22nd for 1990. The buck moth caterpillar population seemed to be less than the prior two years. Population dynamics and control pressures were probably responsible for this reduction. There is still one other factor that was responsible for reduced populations, 140 inches of rainfall in the University Section of the city could have drowned and flushed away many of the pupae that were hidden in the loose leaf litter under the oak trees. The combination of chemical pressure, natural population dynamics and unfavorable weather conditions were probably responsible for the demise of the buck moth population for 1991.

Mosquito production is dependent on rainfall patterns, not on rainfall abundance. With an average rainfall of 109 inches for the year and two areas of the city receiving 140^{+} inches of precipitation, 1991 was just an average mosquito year. With 20 inches of rain in January and 60 inches of rain by the month of May, all floodwater mosquito breeding habitat was inundated and mosquito eggs were oviposited on high ground that would not flood. Abundant rainfall skewed the species distribution from flood water breeding mosquito to permanent water breeding mosquitoes, but the total numbers of mosquito did not change in proportion to the rainfall received. This past year was proof that excessive rainfall does not produce excessive mosquitoes. The interval between rainfall is more important than the volume of rainfall.

ENTOMOLOGICAL REPORT – M.K. CARROLL

From an entomological standpoint, 1991 was an uneventful year. Most of the adult mosquito activity took place in the last quarter, with an increase in Culex salinarius activity. This species comprised 72% of the year's total. In contrast, all floodwater species made up only 4% of the catch (311 Aedes sollicitans and 3,200 Ae. vexans females). In 1965, the first year's light trap data, the catch was 74,953 Ae. sollicitans and 13,352 Ae. vexans, with ten fewer light traps.

January and February produced a few broods of Ae. vexans, which, because of the cool weather, were easily controlled in the larval stage. Relentless rainfall throughout most of the rest of the year prevented the cyclical swale patterns from occurring, keeping the floodwater mosquitoes at bay. This same record rainfall kept impounded marsh levels high, inhibiting Cx. salinarius production while creating "permanent" urban swales which increased production of this species.

During 1991, the largest established area of water lettuce during at least the past 20 years appeared in two lagoons in City Park. This plant is the number one worldwide indicator of Anopheline breeding. Inspection and light trap surveillance during the year produced several species of larvae and adults around this area. It is hoped that the 1991-1992 winter will produce at least one freeze cold enough to kill this tropical plant and allow us to prevent its re-establishment.

FIELD OPERATIONS – ED FREYTAG

Record-breaking rainfall was probably the most significant factor affecting mosquito populations and operational activity for 1991, greatly reducing production of floodwater mosquitoes, but allowing container-breeding species to flourish. A total off 109 inches of rain fell on 137 days this year (see rain charts at the end of the report), turning water bodies which are generally temporary in nature into pools and ditches with permanent-type characteristics. During many of the wettest months, swales never dried up, giving natural predator populations time to become well-established and provide larval control. Various fishes (Cyprinodon varieagatus, Fundulus spp., Lucania parva) were introduced into areas where they would be beneficial, but source reduction and larviciding crews were required to spend many hours draining problem areas and treating larval hot-spots. With continual inspection and larval treatments, few adulticiding treatments (ground or aerial) were required. Several broods of Aedes sollicitans were able to emerge from the tidal flood zones of New Orleans East, but were successfully controlled with aerial adulticiding.

Analysis of the telephone calls regarding mosquito annoyance indicates that only 0.5 complaints/month/spray zone were received at NOMCB headquarters, many of which came from residents living adjacent to the heavily wooded areas of the lower coast of Algiers. Another significant portion of the phone complaints arose from problems associated with container-breeding mosquitoes such as Aedes albopictus, Aedes aegypti, and Culex quinquefasciatus. Inspection teams removed breeding sources whenever possible and educated the public as to their role in mosquito prevention, but the sheer number of containers, coupled with favorable environmental conditions, continue to make control of these species a formidable task. Large tire piles in several sections of the city also added fuel to the fire.

During August and September, gravid traps and CDC traps were placed at 9 sites (18 traps) in various parts of the city to collect mosquitoes for virus isolation. Areas adjacent to horse stables and permanent water bodies, along with areas which showed virus activity in 1990, were monitored bi-weekly for EEE and SLE positives. Over 250 mosquito pools were shipped to the CDC laboratory in Ft. Collins, Colorado, with all pools indicating negative results for EEE and SLE. One virus (unclassified Bunja virus) was isolated from Cx. quinquefasciatus collected from a gravid trap at site number 14 (Joe Madere's).

As part of our pre-season calibration and maintenance operations, all of the LECO ULV units were monitored for droplet size and pressure. It was discovered that many of the pressure gauges were off by as much as 25-50% when calibrated against an accurate gauge at the blower head (they typically read high). New gauges were ordered, but the accuracy of the new gauges was not significantly better than the old ones. Two of the Leco units were delivering droplets with LMD's greater than 17 micrometers (maximum size according to label), and it was felt that droplet size could be decreased by increasing the pressure from the blower. The pressure was successfully elevated on the 2 units, but the droplet size was decreased on only one. Even with 9 psi, a new nozzle and base plate, and a chemical temperature of 96 degrees F (malathion 95%), unit F-86 continued to deliver droplets greater than 17 micrometers. Only after reducing the flow rate from 4 oz./min. to 3 oz./min. did the droplet size conform to label requirements. This information was included in the report so that others might be made aware of the potential problems associated with ULV units, and that solutions and comments might be generated from other mosquito control districts or equipment manufacturers.

OPERATIONAL STUDIES - ED FREYTAG

LARVAL INSPECTIONS

The entomologist became involved in larval inspection when the routine larviciding treatments failed to reduce the adult mosquitoes captured in the New Jersey light traps or when mosquito complaints became excessive. The maps from the routine swale and ditch inspections were used to facilitate locating breeding sites that the inspectors had missed. Usually these breeding sites were found in areas of heavy vegetation or in wooded areas that were not easily accessible. Egg and larval collections were made from these sites prior to treatment to provide specimens for initiating an insectary colony or for testing the susceptibility of these "wild" mosquitoes to insecticides. Inspections efforts were concentrated in the New Orleans East area, the Fairgrounds, and City Park.

Heavy rainfall affected the city during most of January and February, resulted in extensive flooding of swales and ditches. Larval collections indicated that Aedes vexans and Culiseta inornata made up a high percentage of the larvae breeding from these sites. Using the larviciding maps as a guide, several sites in New Orleans East were visited for collecting these species in order to run susceptibility tests. A wooded area was inspected that was not on the map and several large swales were located. Over three hundred egg rafts were collected and brought to the insectary for rearing. The larvae were reared and identified as Culex restuans. An attempt was made to colonize this species but all egg rafts obtained failed to hatch. A susceptibility baseline was obtained from several tests that were made on the F-0 (wild type) generation.

In April when SLE surveys were under way, Culex quinquefasciatus egg rafts were collected in the Bonita St. area of New Orleans East using muck buckets with fish emulsion placed in backyards and wooded lots. This method was not very successful in March because of heavy and frequent rains which would cause the eggs to flow out of the buckets. The muck buckets were checked weekly and contained no egg rafts, although larvae of Ae. albopictus and Ae. triseriatus were present. Egg rafts were not collected until April when the rains subsided. Black ovitraps cups with masonite paddles were placed in the same wooded lots in the Bonita subdivision to collect Ae. albopictus and Ae. triseriatus eggs to initiate 1991 insectary colonies for susceptibility studies. The Ae. triseriatus could not be successfully colonized in the insectary even though no problems were encountered colonizing the Ae. albopictus from the same area.

To collect Cx. salinarius, muck buckets with fish emulsion and hay were placed at the New Orleans fair grounds. Twelve buckets were placed inside horse stables but no egg rafts were collected. The New Orleans Jazz and Heritage Festival was being set up during this time and all horses had been removed from the stables. Mosquito activity increased slightly when the horses were returned to the stables. Routine inspection of the fairgrounds rainstorm drainage system maintained the mosquitoes below nuisance levels.

Larval inspections were made in the City Park lagoons, ditches and canals in and around the golf course to determine if larvae were breeding in the water lettuce (Pistia stratiotes). During the cooler months of spring, the water lettuce was noticeable around the edges of the lagoons, but as the summer progressed, the water lettuce continued to grow and expand its territory until it completely covered the lagoon along Marconi Drive. The larvae of Anopheles crucians, An. quadrimaculatus, and Cx. erraticus were collected among the water lettuce, but never in large quantities. Many minnows and predacious insects were also collected with each dip but it appeared that the water lettuce offered the larvae excellent cover and protection from predators, including minnows.

To determine the proportion of Ae. aegypti and Ae. albopictus in what used to be "gyp" territory, ovitraps were placed in three areas of the city, Banks St. (MidCity), Water Works (Uptown) and the Lower 9th Ward. Red paper velour strips measuring 1x5 in. were used instead of masonite paddles to facilitate handling and hatching in the insectary. The eggs were allowed to embryonate at least 36 hours before hatching in glass beakers. Third and fourth instar larvae were killed in hot water and preserved in 95% ethyl alcohol for species identification using comb scale morphology. The average monthly egg counts are shown in Table 1. Although a significant variation in egg laying was observed on a daily basis, two factors that contributed to a decline in egg laying was lack of precipitation and prolonged high temperatures (>90^{o}F). The ratio of Ae. aegypti eggs to Ae. albopictus collected on the ovitraps is shown in Table 2. The eggs of both species must be hatched to determine the species since the eggs are morphologically unidentifiable. It is clearly shown by the data that Ae. albopictus has not only established itself, but is displacing Ae. aegypti. There are no longer any areas in the city of New Orleans that are inhabited only by Ae. aegypti, and in some areas such as New Orleans East, Ae. aegypti has been completely displaced.

Table 1. Average number of eggs (Ae. aegypti and Ae. albopictus) deposited per strip per day in each area by month.

	Banks St.	Water Works	Lower 9th Ward
June	2.4	6.9	No data
July	3.7	4.6	9.2
August	2.9	2.9	6.8
September (1-9)	1.6	0.7	2.4

Table 2. Ratio of Ae. albopictus to Ae. aegypti eggs deposited per strip per day in each area by month. Counts made by hatching eggs to 3-4th instars.

	Banks St.	Water Works	Lower 9th Ward
July	1.9:1	1:1.2	1.4:1
August	2.9:1	3:1	5.3:1
September (1-9)	3.5:1	No larvae hatched	10.1:1

ADULT MOSQUITO INSPECTIONS

To determine the breeding potential An. crucians, An. quadrimaculatus and Cx. nigripalpus in the water lettuce in the City Park lagoons, six CDC light traps baited with CO_2 were placed in City Park along Filmore between the City Park Country Club and Marconi Drive, and in the horse stable area. The traps were placed in the field at sunset and picked up the next morning. Even though An. crucians adults were the most numerous mosquitoes collected by the light traps in close proximity to the water lettuce, it appeared that the predators in the lagoon were maintaining the larval breeding at a low level. Many Cx. salinarius adults were also collected, probably attracted by the horses in the stables, since they were not found breeding in the lagoons.

The Islander was a very important inspection tool for locating potential mosquito breeding areas when used in conjunctions with an 8 mm video cameras. The low altitude aerial photography gave the inspectors a different perspective of the inspection sites and facilitated locating the wet areas from the ground. Several flights were made over Lower Coast Algiers, Deer Park and Lincoln Beach. The L.C. Algiers area was of particular interest since Cx. salinarius adults produced many telephone complaints from the residents of this area, but no breeding was present in the wet sites located by air. The English Turn golf course was also photographed where trees are being felled and burned to make way for new roads and residences. Careful examination of the video revealed that many swales with a high potential for breeding Psorophora columbiae mosquitoes were being created by the heavy construction equipment. The Deer Park business area and Lincoln Beach were inspected after the video was examined by field personnel. One swale in the woods was still producing larvae in the Deer Park area. At the Lincoln Beach recreation park (out of operation for many years), a large weedy drainage ditch and two pools were inspected, but minnows and other small fish were established and apparently controlling any mosquito breeding.

SLE POOLS

To augment our understanding of the SLE cycle and the mosquitoes involved, adult mosquito pools were collected in New Orleans East during April. The mosquitoes were collected using CDC light traps baited with CO_2 and with gravid traps baited with fish oil emulsion fertilizer. The CDC traps were placed in the storm drain system and in backyards and wooded lots, charged with CO_2 at 3:00 PM and retrieved the following morning at about 9:00 AM. The gravid traps were also placed and picked up at the same time, but were located in areas with high vegetation away from direct sunlight.

The CDC light traps baited with CO_2 placed in storm-drain manholes consistently collected more Cx. quinquefasciatus adults than those placed in wooded lots, with an occasional Cx. salinarius and Cx. restuans showing up. Most of the wooded lot collections consisted of Cx. quinquefasciatus, but in several occasions, Cx. salinarius was the predominant species. Also collected were Ae. triseriatus, Ae. albopictus and An. crucians. Overall, more Cx. quinquefasciatus females were collected with the gravid traps than with the CDC light traps in either wooded lots or backyards. From the adult mosquito collection data, it appears that Cx. quinquefasciatus has found the storm drain system a favorable breeding environment, but only during periods of low rain activity. Many CDC traps were lost in the manholes after water from rain storms rushed through the system, and adult mosquito collections also dropped to zero presumably flushed by the water.

The mosquito pools were sorted on a chill table, labeled and sent to the CDC branch in Fort Collins, Colorado. Results of the laboratory tests were either negative or inconclusive except for one unknown virus isolation.

INSECTICIDE TESTS

In the process of calibration and droplet size determination for malathion from LECO ULV units, it was observed that differences in the way a person scores the size of each droplet on the microscope can drastically affect the results. One individual scored the droplet diameters 1-2 units larger than its "true" size, resulting in an LMD of 19.5 instead of 15.4 micrometers. It is important to properly train technicians to avoid droplet size reading errors which may result in unnecessary grounding of ULV trucks due to droplet LMD's larger than specified on the label.

In many areas of the city where bird bloods were positive for SLE activity, ground treatment with malathion was assigned to prevent possible transmission. To determine the control efficacy of malathion 95% at a rate of 4 oz. per minute, caged tests were conducted against Cx. quinquefasciatus and Ae. albopictus using a LECO ULV truck. The tests were done in the morning in a large field in City Park. One cage (4 in. PVC pipe cut to one in. rings with nylon screen hot-glued on each end) containing 25 Cx. quinquefasciatus female adults and one cage with 25 Ae. albopictus female adults were set up on music stands (3 ft. above ground) at 50, 100, 200 and 300 ft. from the truck's path. The truck was traveling at 10 mph perpendicular to the mosquito cages with a 3-7 mph breeze carrying the insecticide to the target area. Insecticide droplets were collected at various distances using Teflon slides on motorized rotators. Three separate applications were made replacing the cages and slides each time. The test results are shown in Table 3. The LMD obtained at 150 ft. was 11.6 micrometers and at 300 ft. was 12.5 micrometers. The data shows that malathion applied at a rate of 4 oz./minute from a ULV LECO truck is extremely effective against these two mosquito species. Actual operation control may be affected by vegetation, buildings and obstacles, and by wind currents.

Table 3. Summary of caged mosquito tests with Cx. quinquefasciatus female adults. 24 hr. posttreatment. Malathion 95% at 4 oz./min. and 5 psi. Wind speed 307 mph, 85^{o}F and 75% RH.

Spray distance ft.	Run 1 Dead/Total	% Mortality	Run 2 Dead/Total	% Mortality	Run 3 Dead/Total	% Mortality
50	32/32	100.0	22/22	100.0	24/24	100.0
100	28/28	100.0	30/30	100.0	28/28	100.0
200	30/30	100.0	27/27	100.0	24/24	100.0
300	24/24	100.0	24/24	100.0	29/29	100.0
Control	1/27	3.7	1/25	4.0	1/26	3.8

Mortality data for Ae. albopictus was identical at all distances as that obtained for Cx. quinquefasciatus.

In September, personnel were involved in testing the control efficacy of aerially-applied Scourge-Orchex (1:2.33) at 1 oz. per acre against *Aedes albopictus* and *Culex quinquefasciatus* mosquitoes in an urban environment. The test protocol required the use of ovitraps to monitor the natural population of *Ae. albopictus*, bioassays using 3rd and 4th instar larvae and 3-7 day old male and female adults of both species, and droplet collection to determine LMD using Teflon slides mounted on slide rotators.

Approximately 20 adult mosquitoes were placed in each cage and ca. 25 larvae were placed in containers (6.25 in. diameter by 4.25 in. high) with 200 ml of water for each species. One open and one sequestered site was selected for each of five locations in the middle of the test area (Lower 9th), with one cage of adults and one container of larvae of each species per site. Three adult cages and three larval containers were prepared as controls. Slide rotators spinning at ca. 350 rpm with two Teflon coated slides were placed in each of three open and sequestered sites. Oil-sensitive cards were placed vertically and horizontally in all five sites.

The Islander delivered the Scourge-Orchex insecticide mix on 9/7/91 at 1 oz/acre at a flight speed of 115 mph, an altitude of 200 ft. and an effective swath width of 525 ft. At the time application started (6:33 am), excellent weather conditions prevailed with a temperature inversion observed with 78.4^{o}F at 200 ft. above ground and a ground temperature of 76^{o}F and 91% RH, and 0-1 mph winds.

Mortality of all bioassays was read 24 hr. posttreatment. Analysis of the caged adult bioassay indicated an average mortality of 69.8% and 9.8% for *Ae. albopictus* adults (3-7 day old females) in open and sequestered sites, respectively. A significantly lower mortality was obtained for *Cx. quinquefasciatus* adults, with an average of 52% and 3.4% in open and sequestered sites, respectively. Mortality of *Ae. albopictus* larvae averaged 48.9% in open and 5.9% in sequestered sites, while the mortality of *Cx. quinquefasciatus* averaged 40% in open and 14.4% in sequestered sites. The ovitrap data did not reflect an impact on the natural *Ae. albopictus* population. Egg collections on the ovitraps were extremely low in the test area and this trend was also present in the untreated control areas.

The LMD of the droplets obtained from the Teflon slides averaged 32.7 μm in the open sites and 12.3 μm in the sequestered sites. Although plenty of droplets were collected on the slides, very few droplets were present on the oil sensitive dye cards.

SUSCEPTIBILITY TESTS

Plans for obtaining 1991 susceptibility baselines for many of the New Orleans mosquito species were delayed because the colony rearing and maintaining procedures were under a experimental stage and the relocation of the insectary and the toxicology laboratory to the new BioControl facility took several months. Susceptibility tests were not begun in earnest until October.

Larval susceptibility tests were run on wild type Cx. restuans larvae using malathion 95% and Scourge 18%. The larvae were very susceptible to Scourge 18% with a LD_{50} of 0.0016 µg/ml and a LD_{90} of 0.0027 µg/ml. The larvae were moderately susceptible to Malathion 95% with a LD_{50} of 0.051 µg/ml and a LD_{90} 0.115 µg/ml. This mosquito species was collected as egg rafts in swales in a wooded lot in New Orleans East and reared in the insectary for the test.

A series of larval and wind tunnel susceptibility studies were initiated in October with the 1991 insectary colonies of Ae. aegypti (Banks St. strain), Ae. albopictus (Bonita St. strain) and Cx. quinquefasciatus (Bonita St. strain). To ensure reliable LD_{50} and LD_{90} baseline data, at least five separate tests are needed. Each test consists of five dilutions of malathion 95%, plus a control treated with acetone (used as the diluent for malathion), replicated four times. Each replicate consisted of ca. 25 larvae in 250 ml of well water. The wind tunnel test consists of ca. 25 female adults in each disposable paper cage, replicated four times for each of five dilutions. The control were treated with plain acetone. The mortality is read 24 hours posttreatment and analyzed using a probit program on the computer.

Preliminary results of larval susceptibility tests indicated that Ae. albopictus is more susceptible to malathion than Ae. aegypti. Surprisingly, this is a reversal of susceptibility results obtained after Ae. albopictus was discovered in New Orleans. It is possible that the lack of insecticide pressure in New Orleans has resulted in a diluting effect of the more malathion-tolerant genetic pool of Ae. albopictus.

Wind tunnel susceptibility baseline data with malathion 95% was completed for the Cx. quinquefasciatus strain collected from Bonita St. in New Orleans East. Nine tests have been made using approximately 3,087 female adults. It has not been possible to do all the tests on the same generation since the eggs cannot be saved for a later hatch date. No apparent change in susceptibility has been detected between the F_1 to the F_5 generation. It appears, however, that 14 day old females are more susceptible than 7 day old females, as shown in Table 1. This change in susceptibility is due to the effects of aging on the physiology of the adult mosquitoes.

Table 1. Summary of wind tunnel susceptibility tests using malathion 91% on Cx. quinquefasciatus females.

Concentration % A.I.	7 DAY OLD Dead/Total	7 DAY OLD % Mortality	14 DAY OLD Dead/Total	14 DAY OLD % Mortality
0.402	34/206	16.5	54/151	35.8
0.938	67/225	29.8	131/193	67.9
1.474	193/311	62.1	120/137	87.6
1.744	195/282	69.2	137/146	93.8
2.012	149/209	71.3	160/175	91.4
Control (acetone)	28/314	8.9	28/314	8.9
	LD_{50}=1.359 % A.I.		LD_{50}=0.604 % A.I.	
	LD_{90}=3.346 % A.I.		LD_{90}=1.707 % A.I.	

REFERENCE COLLECTION

The mosquito adult and larval reference collection was updated and reorganized to increase its usefulness as an identification reference and as a teaching tool. Larvae for the collection were reared from eggs obtained by capturing live bloodfed female adults in a especially modified CDC light trap or by collecting the larvae in the field. Adults specimens captured with this trap were also frozen and later identified and pinned using minuten pins, a very slow and tedious process. The collection was updated all year long since many specimens were destroyed during handling in identification workshops.

Larvae of Culex nigripalpus and Cx. erraticus were collected and reared to adults in separate containers. The larvae are easy to identify with a dissecting microscope, but the adults are almost undistinguishable. Microscope slide mounts of the wings were made to demonstrate the difference in wing scales. Several attempts were made to try to colonize these species but the egg rafts obtained would not hatch.

Several mosquito species found in New Orleans such as Aedes fulvus pallens, Ae. tormentor, Anopheles atropos, Culiseta melanura, Uranotaenia sapphirina and others are seldom abundant and rarely collected due to their specific habitat or life cycle. Very few specimens have been collected of these species, but eventually the NOMCB reference mosquito collection will have specimens of all species.

BUCK MOTH CATERPILLAR – STEVE SACKETT

The Buck Moth Project for 1991 was successful in reducing populations of buck moth caterpillars in many sections of the city by combining the resources of federal, state, and local agencies. NOMCB was responsible for conducting biological surveys of eggs, larvae, and adults, while the Parks and Parkway Commission worked closely with the spray contractors, neighborhood associations, and individuals who were involved with treating the trees. For the sum of $40, trees were monitored, treated for caterpillars, and fertilized. In situations where pre-treatment surveys indicated that trees were not infested, several individuals and organizations opted to invest their money in the fertilization program to improve the quality of the trees. We are indebted to the U.S. Forest Service and the State Department of Agriculture for providing reimbursement to the city for expenses (38% of costs), and providing technical assistance.

Biological surveys conducted this year indicated that in most cases, buck moth populations have declined in areas that have received treatments over the past few years, while untreated areas generally are stable or increasing. Surveys for buck moth eggs were conducted during January and February with the help of the Parkway tree trimming crews. Branches from 183 trees along St. Charles, Louisiana, Magazine, S. Carrollton, Napoleon, Jackson, and Washington avenues were examined for egg masses, with only 2 masses collected. This compares with 28 masses collected from 257 trees examined in 1990.

The first hatch of caterpillars in the field was observed on March 4, several weeks after the anticipated hatch date (first hatch for 1989 and 1990 was Feb. 15 and 22, respectively). By that time, most of the oaks had developed a significant amount of new leaf growth, providing an abundant food source. Over 5,300 oak trees were examined for larvae, with reduced populations showing up in most areas. Contractors began treating with Btk (a bacterial insecticide) on March 22, but by March 28, fourth instar caterpillars were observed in the field. It was interesting to note that in 1991, the development time from first hatch to fourth instar was only 24 days, compared to 34 days in 1990. Contractors switched to Tempo 2 after the fourth instar was reached, completing their spray assignments by April 20. A total of 4,469 trees were treated, with 4,350 of them inspected by post-treatment evaluation crews to ensure efficacy of the control program.

In early April, a small-scale cooperative study between LSU, NOMCB, and Parkway was initiated to determine the effects of buck moth caterpillars on the defoliation of oak trees. Approximately 15,000 3rd and 4th instar buck moth larvae were collected from infested oak trees so that known numbers of insects could be reintroduced onto oak trees in another area. Five large trees located on state-owned property in an unpopulated section of the city (eastern Chef Menteur Highway) were selected to receive either 2,000 or 3,000 larvae per tree. Following heavy feeding by the insects, spotty defoliation was evident in many sections of the crowns, but new leaf growth appeared shortly after vegetation had been stripped. It appears that larval infestations of this level are not sufficient to cause any long-term damage to the trees.

Pupal surveys conducted in October and November were used as an additional tool for monitoring buck moth populations. Although 15,000 caterpillars were introduced to the oaks along the Chef Menteur Highway, not a single pupa was found in that area. Pupae are generally located under the leaf litter and can be difficult to locate, but it is very possible that the heavy spring and summer flooding killed or washed away a high proportion of the insects from the study site. Pupal searches were also conducted in other areas throughout the city, indicating a good correlation between treatments and lack of buck moth pupae.

Adult buck moths were first observed in the city on November 14, but emergence and flight activity did not peak until mid-December. As with our other surveys, few moths were observed in areas which had been treated. The greatest concentration of moths was observed in the Castle Manor subdivision in New Orleans East, where 30-90 adults were counted per block.

ENCEPHALITIS SURVEILLANCE - C.J. LEONARD

Twenty-one bird traps were deployed this year to begin the surveillance season. Additional traps were placed in areas that were suspected of virus activity last year. The traps were operated one week in april at the request of the State Lab so that they could verify the test procedures. Surveillance began in May, and a summer worker was trained to take over most of the trapping operations.

The year 1991 set new records for rainfall in New Orleans. This kind of weather usually has an adverse effect on trap performance; however the redesigned traps which include food, water, and a sheltered area, performed very well under these conditions. Mist nets were not used because the excessive rainfall precluded advance baiting of trap areas.

All samples were negative until the third week of August when nine samples were reported positive for Eastern Equine Encephalitis. This amounted to a rate of 9.4% for that week, and since there was considerable EEE activity reported from the southeastern United States, these positives were taken very seriously. Even though most of the positives occurred in adult birds, the ELISA test that is used detects new antibodies, so that all positives are considered significant.

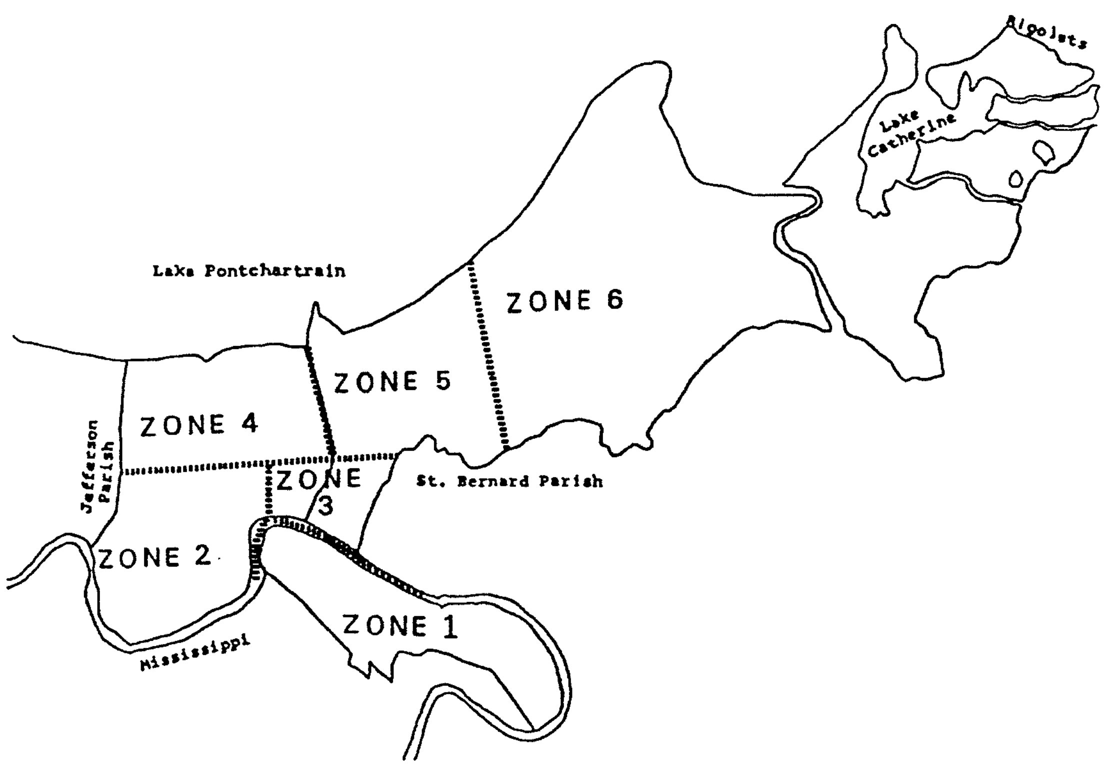
The standard response to a potential Encephalitis outbreak was initiated. Control and surveillance measures were intensified as we prepared for a major outbreak. Mosquito pools were collected and sent to the Centers for Disease Control for virus isolation.

The next week 157 samples were taken with emphasis in the areas that were previously positive.

No further positives were reported, and control and surveillance measures returned to normal levels.

Last year's problems with the lack of confirmation of test results have not been redressed despite assurances to the contrary. Despite the absence of confirmed test results or other supporting evidence we have no choice but to respond to these positives aggressively.

All subsequent samples were reported negative, and no results were received from the mosquito pools sent to CDC. Surveillance was terminated at the end of September.



		ENCEPHALITIS SURVEILLANCE - YEAR-TO-DATE							
SPECIES		ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	TOTAL	# POS.
Sparrow	Immature	23	26	9	30	1 \ 174	1 \ 122	384	2 \ 0.5%
	Adult	35	1 \ 52	15	44	205	2 \ 197	548	3 \ 0.5 %
Others	Immature	29	15	4	6	30	24	108	0 \ 0 %
	Adult	52	37	9	9	3 \ 153	1 \ 101	361	4 \ 1.1 %
	Total	139	1 \ 130	37	89	4 \ 562	4 \ 444	1401	9 \ 0.6 %

AVIATION OPERATIONS - JOSEPH RIEDL

Aircraft usage this year was normal compared to previous seasons. Along with adulticiding, the airplanes were flown on inspection, surveillance, training, test and research flights. Both the Britten-Norman Islander and the Grumman Ag-Cat are in fine shape. No unusual problems were encountered in their operation.

The F.A.A. Annual Inspection was completed on the twin-engine Islander in February. In March, the same inspection finished on the Ag-Cat. Altimeter and transponder tests were done to comply with a two year requirement on the airplanes. All tires and tubes were changed on the Ag-Cat. At the same time, the wheel bearings were cleaned and re-greased. A leaking magneto seal was replaced on the single-engine aircraft. Routine preventative maintenance was carried out to assure continued reliable operation on both machines.

After many years of anticipation, the hangar was finally constructed. Aircraft, tools, equipment, supplies, etc. was moved to the facility. Aviation operations have become much more efficient. Ease of maintenance and protection of the aircraft and associated equipment has made the building a valuable asset.

The Aviation Supervisor retired this past year. He had been employed here a long time. A new supervisor has replaced him. The transition occurred during part of 1990 and 1991. Two contract pilots are still retained for their services. An additional pilot, within the mosquito control department is also available. Maintenance is still performed at our facility. Aircraft operations have not changed.

Paperwork was routine. Aircraft log books were kept current. Revisions were inserted into the manuals. Spray operation notification was publicized. Records were maintained. The office was set up for more effective usage.

Mosquito activity decreased toward the end of the year. Efforts were, at this time, concentrated on plans and preparations for the next season. Much work was also done in setting up equipment in the hangar.

SOURCE REDUCTION – BROOKS HARTMAN

For most of 1991 the source reduction program was active with inner city projects, new ditch construction, removal of dense overgrowth along existing ditch, and clearing of obstruction from storm drains and drainage pipe within existing source reduction areas in Orleans Parish. All areas will be monitored in the coming year.

The W-2 wetlands project (east of Paris Road) is still on hold pending the Nature Conservancy Land Use Plan. Ditching of the W-2 project is very important to eastern New Orleans because of its proximity to schools, shopping centers and residential areas. Bid specs for the new amphibious rotary excavator that will be utilized in the W-2 wetlands area are being put together at this time and will be out on bid in the near future.

PUBLIC EDUCATION - C.J. LEONARD

The video on copepods, "COPEPODS - BIOLOGICAL CONTROL THAT WORKS" was completed early this year. Composed mostly of microphotography of copepods, including feeding on larvae, this tape explains the problems and potential of this new biocontrol agent.

This is the first tape made at NOMCB using a new procedure for producing a preliminary draft for review before editing the master tape. The raw footage is copied to VHS with on-screen time code. These VHS tapes are used to edit a preliminary or rough cut that can be reviewed and changed before the master edit begins. This allows the reviewers to see what the actual video will look like instead of simply reading a script. It also saves wear and tear on the master tapes so that a high quality master is produced. This process actually saved a great deal of time both in the preliminary and final edits.

Distribution of several of our videos to schools through the school board's cable TV channel continued as in the past. Teachers are notified of broadcast times so they can fit these videos into their lesson plans. Several Public Service Announcements have been provided to all local broadcast media. These 30 second spots are broadcast by the stations as a public service. They have the potential to reach large segments of the population in a very cost effective manner. They are free except for the cost of production and duplication.

All of our existing tapes are being reviewed so that they can be updated. The first to be redone is the fogging video. Several parts of this tape are out of date, and since it was originally made on an old 1 inch format, the entire production will be have to be reshot. As of the end of the year, the script is finished and reviewed, and several animation sequences have been produced using a combination of character generator and camera effects.

Other projects completed this year were, a video presentation to the LMCA workshop on public education in mosquito control, revision of the handout used for various classes and general information, and preparation for the AMCA annual meeting that was held in New Orleans this year.

BIOLOGICAL CONTROL - GERRY MARTEN

As in previous years, the primary objective of our biological control program has been to develop new methods of biological control for integration into mosquito control while we reduce the use of chemical pesticides.

Two years ago we began field trials with larvivorous copepods in discarded tires around the city. (We call the copepods "cyclops".) Two species of cyclops (Macrocyclops albidus and Mesocyclops longisetus) proved to be particularly effective, and we now use them on a routine basis.

Last year we began to explore the possibilities for using cyclops in groundwater habitats. We continued the groundwater program during 1991 and expanded it to cover a variety of habitats ranging from roadside ditches and swales to large marshy areas.

During 1991 we also started to explore new forms off biological control in addition to cyclops, focusing our attention on planaria and larvicidal algae. The larvicidal algae are particularly promising and should go into operational use soon.

Cyclops in tires

Survival of Macrocyclops albidus has been excellent when we introduce them into tires around wooded areas, a situation that is particularly common in the eastern part of New Orleans. Many tires that we treated with Macrocyclops two years ago still contain the cyclops, and control of Aedes larvae is excellent. We can maintain effective control in these tires by treating them with Macrocyclops albidus or Mesocyclops longisetus every spring.

We have found that Mesocyclops longisetus is our most effective species for tires out in the open and exposed to hot summer conditions. Control of Aedes larvae in tires containing Mesocyclops longisetus is excellent. Mesocyclops longisetus has a disadvantage that it does not survive the winter as well as Macrocyclops because Mesocyclops longisetus is more sensitive to freezing winter temperatures.

We learned about some of the practical considerations of applying cyclops to large tire piles when we used Mesocyclops longisetus to treat a pile of about 25,000 tires in the middle of New Orleans during 1991. The main mosquito at the pile was Ae. albopictus. We only needed to treat the tires on the surface of the pile. We never find Ae. albopictus larvae in tires deep down in a pile.

We started in the spring, when Ae. albopictus was breeding in tires at the edge of the pile. There were weeds around these tires, which provided plant material to generate food for mosquito larvae inside the tires. Mesocyclops longisetus was introduced to these tires in the spring and maintained control until the end of the year.

However, Mesocyclops longisetus was not able to survive in most tires at the middle of the pile. These tires were too clean inside to provide food for cyclops. Nor was there food for mosquito larvae, until August when phytoplankton blooms in these previously clean tires provided food. Once there was food for mosquito larvae, there was also food for cyclops, and the tires could be treated successfully with cyclops. This experience impressed us with the importance of timing when treating a large tire pile.

Larvicidal algae

Larvicidal microalgae may help us with clean tires like the ones described above. During 1991 we prepared a pure culture of a species of algae that we often see naturally in tires in New Orleans, especially in tires exposed to the hot summer sun. Mosquito larvae never survive in tires that contain these algae, apparently because they eat the algae to the exclusion of other food. They are unable to digest these algae, so they starve.

We do not yet know the scientific name of these algae. We have it narrowed down to the genus Chlorella or a closely related genus such as Palmellacoccus.

The strategy for using these algae is to put them into clean tires at the beginning of the summer. When algae bloom in the tires later in the summer, we hope they will be the species that we introduced, which will not support mosquito production.

One of the difficulties with biological control in tires that are exposed to the sun is the fact that they dry out during periods without rain. We expect our larvicidal algae to do well in tires like this because they can survive when a tire dries out.

We set up a small pond outside the Biocontrol Laboratory to mass produce these algae. It is clear that we can produce them in any quantity we need. We plan to begin large-scale field trials with these algae at the beginning of summer 1992.

Cyclops in ground water

During 1991 we studied the role of natural cyclops populations for mosquito control in a variety of groundwater habitats: marshes, grassy swales (temporary pools), woodland pools, rice fields, and septic ditches. Some of the work was done in collaboration with mosquito control districts in St. Tammany Parish, Jefferson Davis Parish, and Cleveland, Mississippi.

The particular species of larvivorous cyclops that we found in different groundwater habitats varied with the habitat, but the general pattern was the same in all habitats. There were natural populations of larvivorous cyclops in a substantial percentage of the sites that we examined, and mosquito production was low in those sites. However, each kind of habitat had a substantial percentage of sites that did not contain larvivorous cyclops, and most of the mosquito production was concentrated in those sites.

In each of the groundwater habitats--marshes, grassy swales, woodland pools, rice fields, and septic ditches--we conducted experimental cyclops introductions to see if we could maintain the cyclops in more sites and on a more continuous basis than happens naturally. We used the following species of cyclops:

Breeding habitat	Species of cyclops
Marshes	Mesocyclops longisetus, Macrocyclops albidus
Grassy swales	Macrocyclops albidus, Acanthocyclops vernalis
Woodland pools	Macrocyclops albidus, Megacyclops viridis
Rice fields	Mesocyclops ruttneri, Mesocyclops longisetus
Septic ditches	Macrocyclops albidus, Megacyclops viridis

Target species of mosquito larvae included Ae. aegypti, Ae. albopictus, Ae. triseriatus, Ae. vexans, Ae. sollicitans, An. crucians, and Cx. quinquefasciatus. (We cannot use cyclops for Cx. salinarius control because Cx. salinarius larvae seem to be resistant to cyclops predation.)

In general, the introductions were successful. It appears that operational use of cyclops in most groundwater habitats will require reintroduction at least once a year to ensure the most complete coverage. We cannot expect cyclops to provide perfect control in groundwater habitats, but treatment with cyclops should substantially reduce the number of sites that require larviciding. To make the treatments last as long as possible, it is important to coordinate the treatments with seasonal wet/dry cycles that affect cyclops survival in these habitats.

Planaria

We conducted laboratory tests with two species of planaria (Dugesia doratocephala, Dugesia tigrina), which proved effective in containers like tires or 50-gallon drums as long as we had enough planaria in the container. However, planaria do not have the impressive powers of self-replication that make cyclops so attractive. We have to apply large numbers of planaria to a container or groundwater site for treatment to be effective, and once introduced, planaria numbers decline over a period of weeks or months until there are no longer enough to provide effective control. Because operational use of planaria would require the application of enormous numbers, and we do not know how to produce them in such large numbers at a reasonable cost, we have no immediate plans to put planaria into operational use.

International cooperation

In association with the Public Health School at Tulane University, we provided technical support for the use of cyclops in two community-based projects for Ae. aegypti control sponsored by the Rockefeller Foundation. One of the projects is in Puerto Rico and managed by the Centers for Disease Control's Dengue Laboratory in San Juan. The other project is in El Progreso, Honduras, and is managed by the Honduran Ministry of Public Health and the Pan American Health Organization. USAID's Vector Biology and Control Project has provided supplementary funding (through a contract with Tulane University) to assist our efforts in Honduras.

The main task during 1991 was to survey local cyclops in Puerto Rico and Honduras and conduct field trials to determine which species do the best job in container habitats where _Ae. aegypti_ breeds. The most effective species in Puerto Rico was _Mesocyclops aspericornis_, and the most effective species in Honduras was _Mesocyclops longisetus_. (_Mesocyclops longisetus_ is also native to the New Orleans area and is a major part of our biological control operations in New Orleans.)

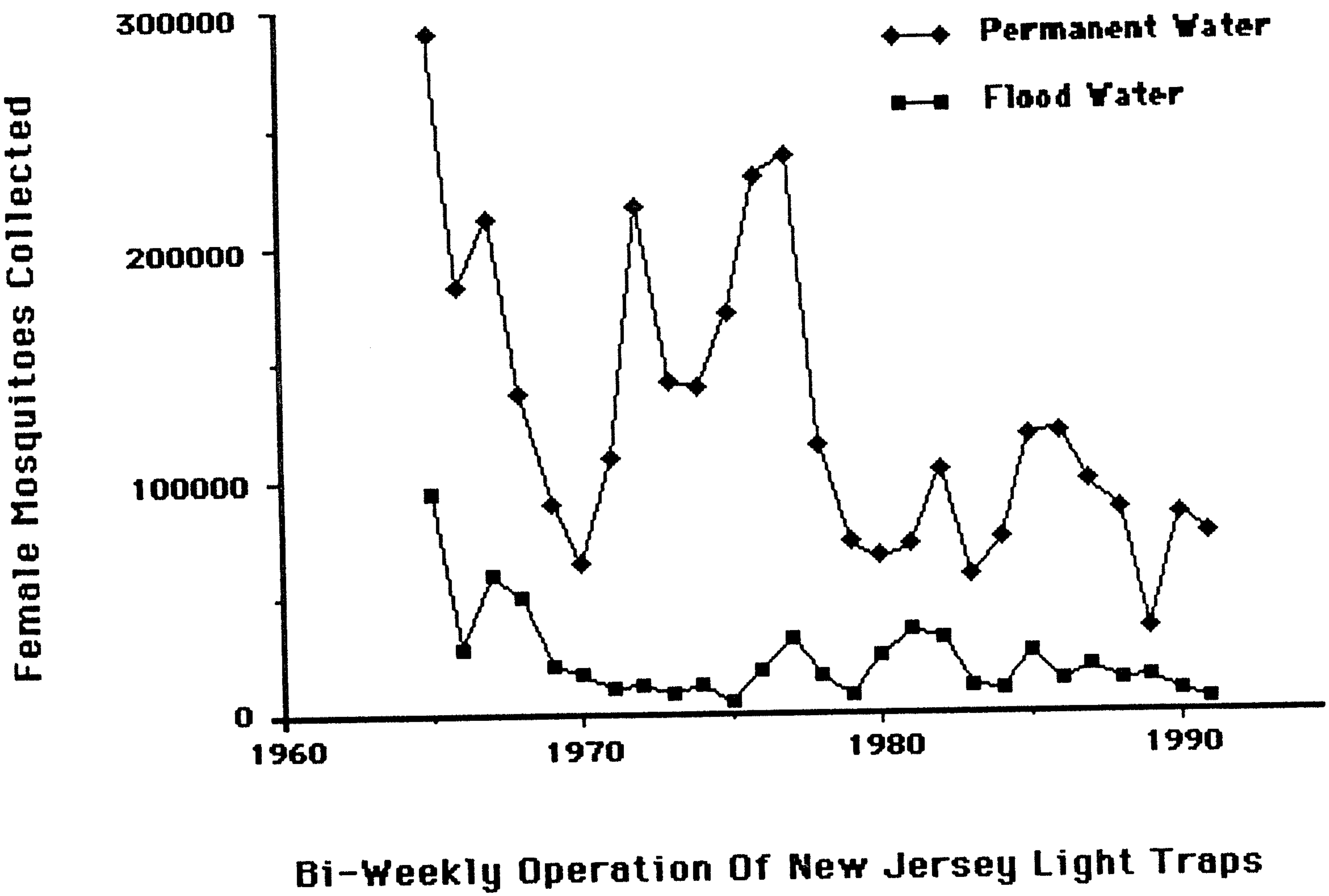
These cyclops were effective for _Ae. aegypti_ control not only in tires, which are a major source of _Ae. aegypti_ everywhere, but also in cisterns and water storage containers such as 50-gallon drums, which are in common use in many tropical areas like Puerto Rico and Honduras. They were also effective in bromeliads and vases.

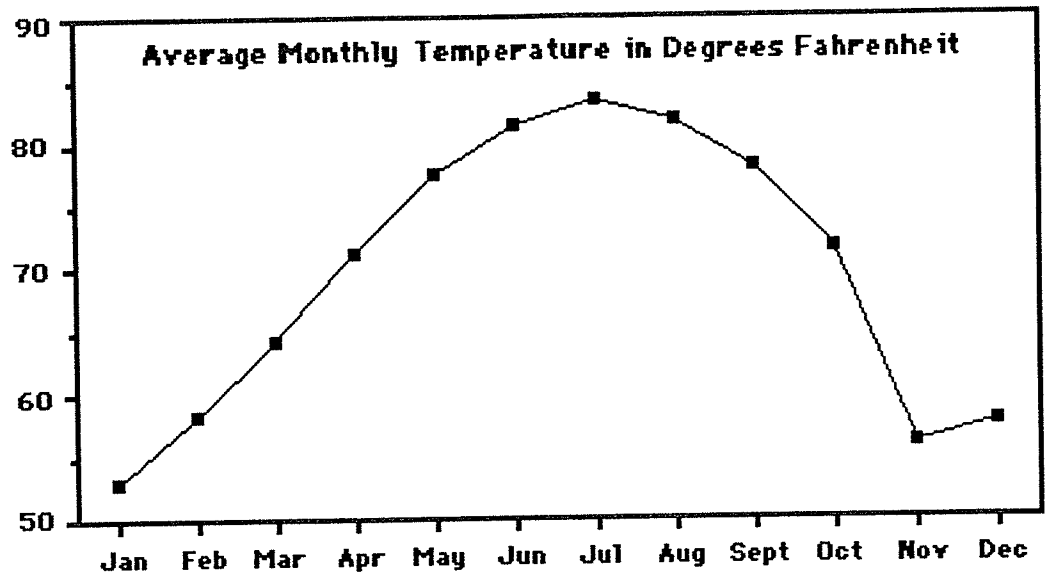
The field trials in Puerto Rico and Honduras showed us that cyclops can provide reliable long-term treatment for a container as long as the container does not dry up, and as long as the cyclops are not dumped out. To keep cyclops in containers that are cleaned periodically, it is best to capture some of them with a net before cleaning, so they can be returned to the container afterwards.

* * *

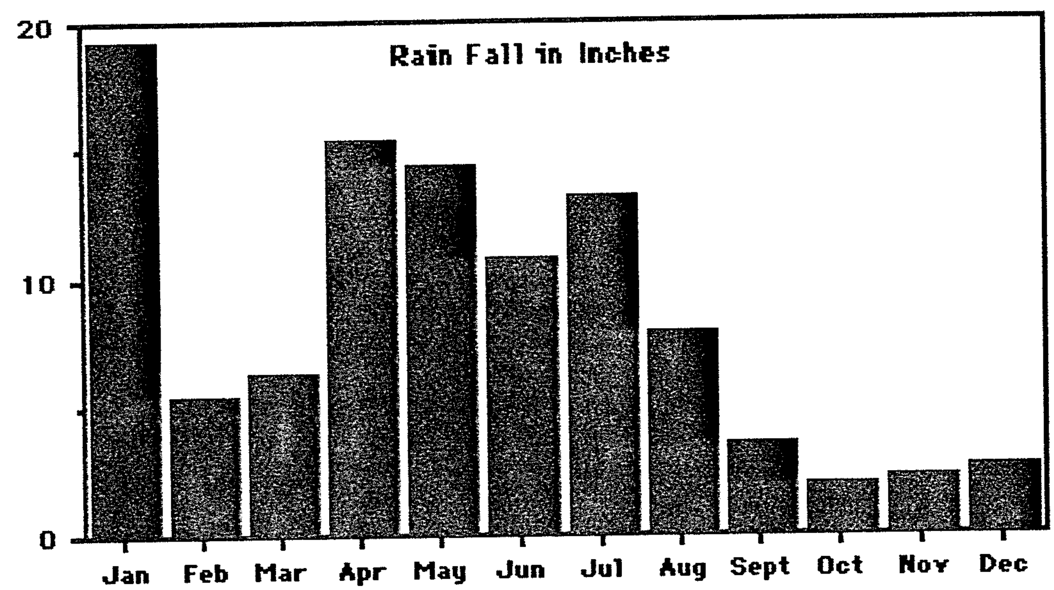
1991 Light Trap Collections

	Male	Female	Aes	Aev	ANc	ANq	Cxq	Cxs	Uran	Culex	Aedes	Cqp	Ps	Csi	Other	Days
1. Willow Drive	674	10443	4\24	32\404	16\158		0\12	607\9142	4\88	0\38	0\43		8\263	3\256	0\15	103
2. Tall Pines	460	1777	1\5	25\186	0\25		0\27	412\1267	0\80	1\41	0\1		19\95	2\50		86
3. Norland Avenue	117	431		8\27	1\9		2\6	97\186	0\172	3\13	0\6		4\5	1\7	1\0	104
4. Olivier Street	228	584		11\68	0\16		2\30	199\381	1\7	2\27	11\19			2\36		95
5. Seine Street	120	459		4\42	1\7	1\0	1\18	104\335	0\8	0\10	5\16		0\5	3\17	1\1	104
6. Tennessee Street	312	1065		18\74	3\45		3\41	265\830	5\30	1\17	11\2		0\4	6\22		104
7. Louire Street	21	93		1\9	0\5		0\5	20\45	0\9	0\7	0\6		0\1	0\5	0\1	104
8. Marengo Street	74	257	0\1	11\41	2\10	1\0	11\28	47\119	0\26	2\27	0\2			0\3		95
9. LA Avenue	253	515		7\81	2\10		5\52	225\295	0\11	7\45	3\7		1\3	3\11		104
10. Hillary Street	142	523		7\48	0\33	1\1	1\32	116\326	0\11	6\55	9\4	0\1	0\1	2\11		86
11. Audubon Zoo	468	1793		79\308	39\222	2\6	4\201	304\750	2\68	25\156	6\4		2\20	5\46	0\12	104
12. Trafalgar	334	1164	0\2	18\167	8\156	0\2	0\18	292\702	0\16	8\37	1\4		4\13	3\42	0\5	101
13. City Park	213	1568	0\6	19\173	14\199	1\2	1\53	161\874	0\15	9\113	5\1	0\1	0\59	3\68	0\4	101
14. S. Genois	32	86		3\22	1\7		2\11	25\34	0\3	0\3	1\3		0\1	0\2		104
15. Longvue Gd.	514	2123		80\272	16\142	0\7	7\144	349\1242	1\81	11\156	5\4	0\2	13\2	30\62	2\9	102
16. Killdeer Street	546	1503	0\4	50\139	25\162	0\2	0\21	452\923	0\96	3\50	4\6		2\6	10\94		102
17. Louisville	121	345		15\74	3\29		1\7	88\160	1\3	3\25	1\1	0\3		9\42	0\1	104
18. Pont. Park	256	681		34\74	1\4		1\34	214\513	0\10	0\6	1\1		1\5	3\34	1\0	102
19. Acacia Street	71	144	0\1	13\12	4\6		1\3	48\39	1\71	2\4	1\2		1\1	0\5		104
20. Werner Drive	405	1452		17\89	4\41	0\2	4\30	364\1190	0\39	2\23	2\7		1\2	11\27	0\2	104
21. Lil. A'Corn	818	2540	2\8	56\172	2\209	0\4	8\48	690\1766	0\29	4\28	2\2	1\0	5\49	48\225		103
22. Vincent	869	5583	0\9	29\139	17\560	1\9	0\23	763\4262	13\234	6\80		2\79	0\49	38\138	0\1	104
23. Vil. DeL'Es.	152	868	0\8	15\69	5\89	0\9	0\3	120\604	2\5	0\18	1\4	0\13	0\1	9\44	0\1	100
24. Resthaven Mem.	452	4962	3\47	2\56	30\127	0\8	0\12	409\4233	0\374	2\31	4\3	0\5	0\8	2\57	0\1	98
25. Joe Madere's	330	4149		4\5	13\216	0\20	0\4	233\2824	28\866	32\127		16\54		4\33		82
26. Lk. Barrington	188	409		16\25	1\5		0\5	149\283	0\30	1\20		1\0	3\0	17\40	0\1	103
27. Irish Bayou	643	8353	0\4	4\22	102\567	0\9	0\12	524\7024	0\376	7\115	0\7	0\25	0\15	6\168	0\9	100
28. Venetian Isles	485	4850	0\29	0\32	32\316	0\1	0\8	453\4210	0\144	0\17	0\34	0\2	0\6	0\51		95
29. Green Ditch	237	7701	1\62	4\22	73\1845	0\16	4\6	126\5612	0\7	0\25	22\32		0\8	7\66		102
30. Rigolets	793	3078	0\95	2\26	87\325	0\1	0\9	677\2465	0\36	9\40	0\23	0\2	0\12	18\44		100
31. Lake Forest	663	2688	0\6	13\148	16\106	4\5	0\4	552\2028	4\74	31\163	1\7	0\2	0\6	39\135	3\4	104
32. Oak Island	1958	13614		34\174	369\3789	6\156	0\16	497\6889	242\1434	785\907	0\1	8\136	0\16	17\87	0\9	102
Total	12949	85801	11\311	631\3200	887\9440	17\260	58\923	9582\61553	304\4453	962\2424	96\252	28\325	64\656	301\1928	8\76	3207
%			0.4	3.7	11	0.3	1.1	71.7	5.2	2.8	0.2	0.4	0.7	2.2	0.1	

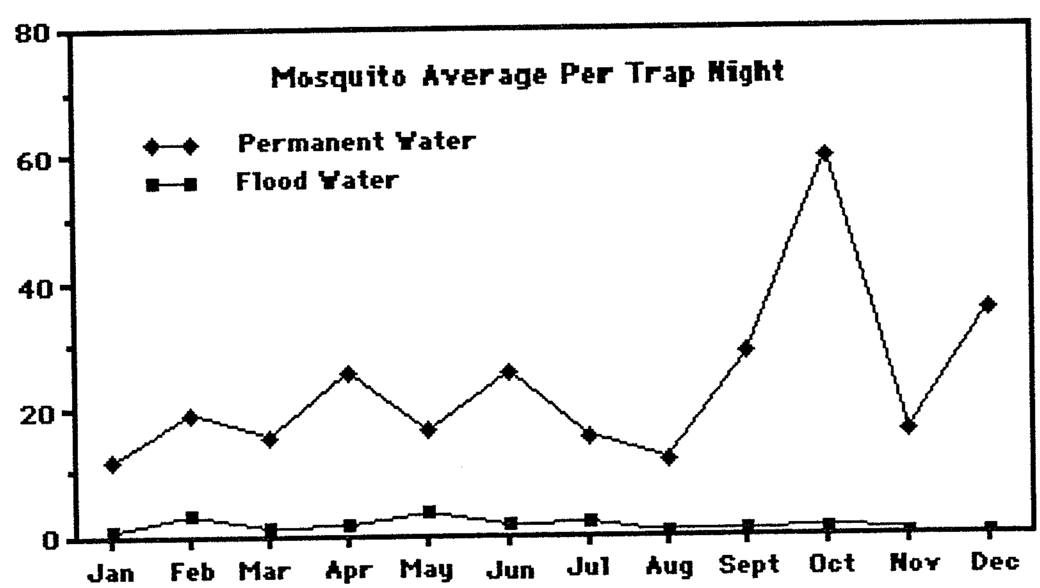

Female Mosquitoes Collected
300000
200000
100000
0
1960
1970
1980
1990
Permanent Water
Flood Water
Bi-Weekly Operation Of New Jersey Light Traps



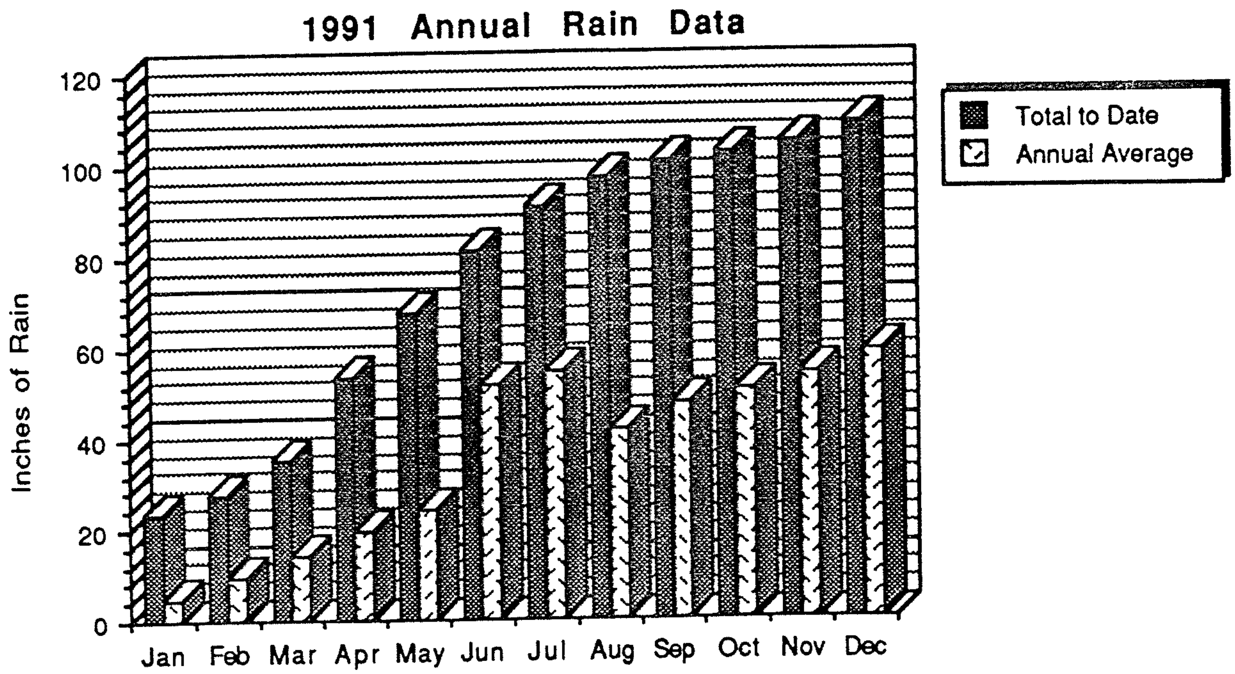
Average Monthly Temperature in Degrees Fahrenheit
90
80
70
60
50
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec



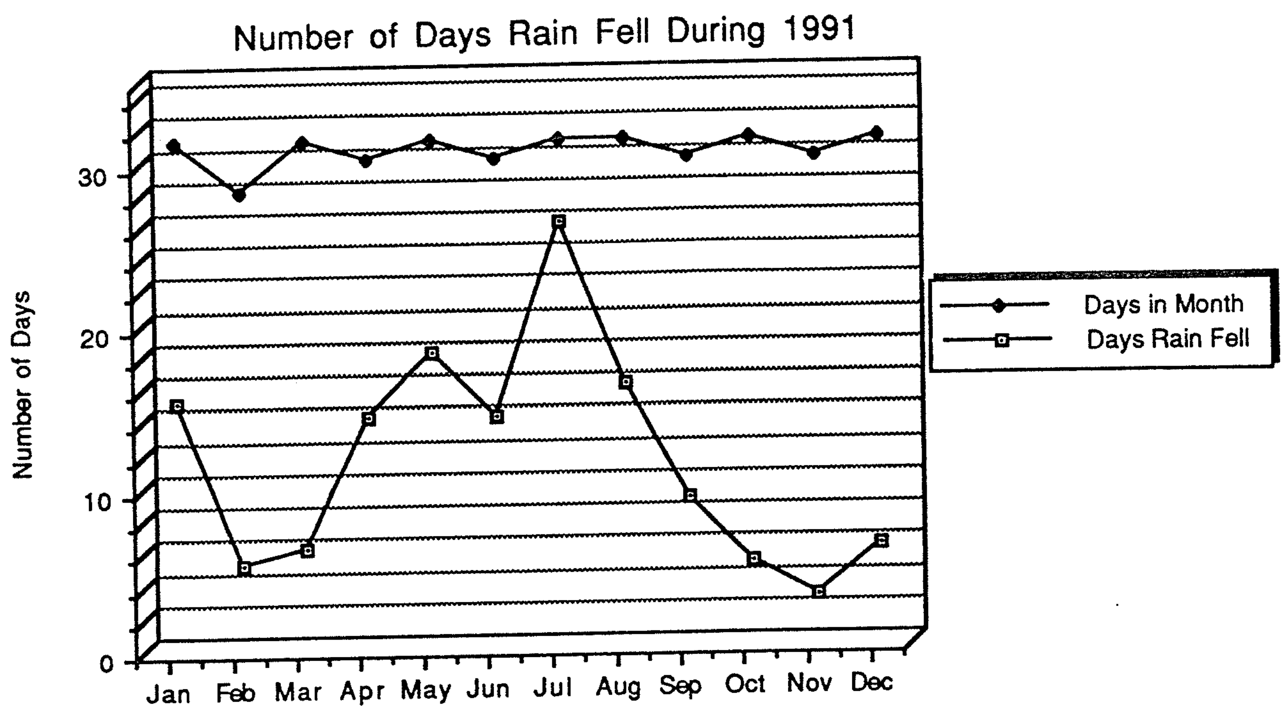
Rain Fall in Inches
20
10
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec



Mosquito Average Per Trap Night
Permanent Water
Flood Water
80
60
40
20
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec

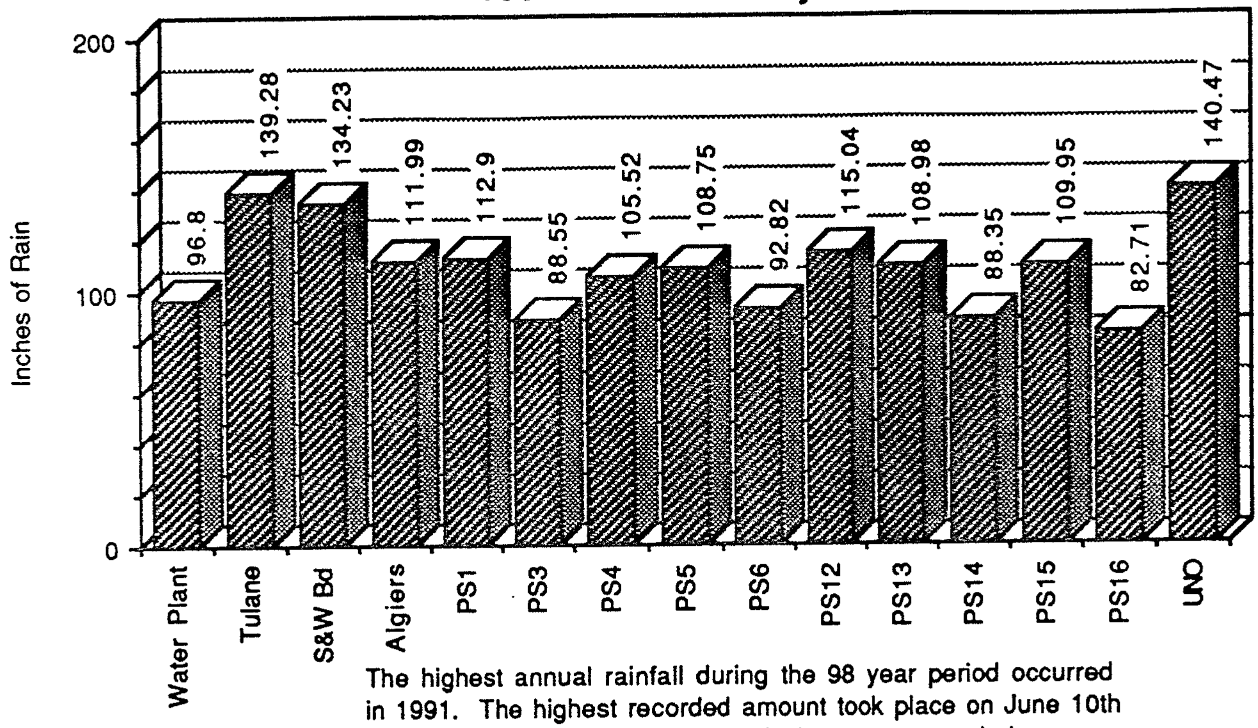


When compared to the annual average rainfall it is clear that 1991 will be recorded as one of the wettest with 109.09".



A record 109.09 inches of rain fell on 137 days in 1991 making this one of the wettest years on record. The last record year was 1983 when 75.41 inches of rain were recorded.

1991 Rainfall by Station



The highest annual rainfall during the 98 year period occurred in 1991. The highest recorded amount took place on June 10th at the Tulane gauge when 10.56 inches were recorded.

STATIONS	LOCATION
N.O. Water Plant	8801 Spruce St.
Tulane University	8623 St. Charles Ave.
Sewerage & Water Board	625 St. Joseph St.
Algiers Water Plant	1120 Elmira St.
D.P.S. No. 1	2501 So. Broad St.
D.P.S. No. 3	2251 No. Broad Ave.
D.P.S. No. 4	5700 Warrington Dr.
D.P.S. No. 5	4841 Florida Ave.
D.P.S. No. 6	345 Orpheum St.
D.P.S. No. 12	7223 Ponchartrain Blvd.
D.P.S. No. 13	4201 Tall Spruce Dr.
D.P.S. No. 14(Jahncke)	12200 Hayne Blvd.
D.P.S. No. 15	Gulf Intracoastal Waterway
D.P.S. No. 15(St.Charles)	7200 Wales St.
U.N.O.	University of New Orleans-Lake Front

HAROLD TRAPIDO
1916 - 1991

Harold Trapido, late professor emeritus Louisiana State University School of Medicine, passed away July 25, 1991, after a long illness.

Harold always wished to be considered a biologist rather than a zoologist, botanist or, say medical entomologist. In thoughts, he relived the age of Victorian naturalists, versed in the intricate ways of creatures and their encompassing terraqueous world of plants -- dated thoughts or visions, perhaps, no longer particularly popular, nevertheless still shared by an ever shrinking group of diehards.

Harold was born in Newark, New Jersey on December 10, 1916. His father, Samuel Trapido, a native Lithuanian who came to this country in 1906, was a dry goods salesman. His mother, Ida Goldberg, was born in New York City.

From an early age he showed a keen interest in natural history and was constantly bringing home lowly creatures which were kept as pets in the basement; scouting activities with future scientists Libero Ajello (mycologist) and Charles Weiss (marine biologist) fueled many of these diversions. Much to his mother's dismay, reptiles became an early concern and eventually the nether regions of the Trapido home housed a number of snakes, including at least one important fecund female timer rattlesnake. This 4-foot creature, caught August 20, 1933, gave birth to 10 young September 8 and the entire operation (previously unrecorded) was carefully observed, becoming the subject of Trapido's earliest recorded scientific contribution but not published until 1939.

Following graduation from Barringer High School in 1934, Harold, with an interest in evolutionary biology, entered Cornell University where he received his B.Sc. in zoology 1938, his M.A. 1939 (minor botany), and Ph.D. 1943, again concentrating on zoology and botany but also delving into science education. His thesis was entitled "Snakes of the genus Storeria", a systematic and zoogeographical study. Throughout this period of academia, Harold was also eking out a living, nourishing both mind and pocketbook. During the summer of 1935 he was a day Assistant in the Science Department of Newark Museum and nights found him Keeper of Reptiles at the Staten Island Zoo. Summer 1936 saw him Biologist for the National Park Service surveying aquatic vegetation at TVA's Reelfoot Lake, TN. During the summer of 1937, Harold assisted his professor, Robert Clausen, on a botanical expedition to the Gaspé Peninsula and southern Labrador. Again in 1940 he assisted Clausen on a botanical expedition to the western USA for a cytogenetic and taxonomic study of the genus Sedum. In 1938, Harold worked for the New York State Conservation Department surveying marine fish of Long Island. And during the summers of both 1939 and 1941, he worked for the Vermont Conservation

Department undertaking ecological surveys of lakes and ponds.

The war years caught up with Harold in the form of the draft. From July 1942 to August 1943 Private Trapido found himself in the Medical Department at Camp Grant, IL and then Paine Field, Everett, WA. In August 1943 he was commissioned 2nd Lt. and served for about one year as Post Entomologist and Assistant Medical Inspector, Camp Davis, NC. While there, Harold learned about DDT (then classified) and drafted a project calling for its investigation and presented it to Oliver McCoy in the Surgeon General's Office. Although nothing came of the plan, May-June 1944 was Harold completing a course in Military and Tropical Medicine at Walter Reed Army Medical Center, Washington, DC, following which, at McCoy's request, he was assigned to Gorgas Memorial Laboratory, Panama, for work on an O.S.R.D. contract to study the effectiveness of DDT residual spraying in the control of malaria. The upshot of the ensuing investigations represented the first use of this very promising insecticide in Latin America. It was not long before Trapido realized that not enough was known regarding the adult habits of certain important anophelines and thus initiated studies of the natural behavior of mosquitoes (all stages), which subsequently became one of his primary research interests. Harold was honorably discharged from the Service in August 1946, grade Captain; he remained, however, in the Medical Service Reserve Corps as Major until 1960.

For 10 years (1946-56) Harold was employed as Biologist by the Gorgas Memorial Laboratory, whose Director initially (1929) was Herbert Clark, followed by Carl Johnson in July 1954. During this period, his publications can be divided into 3 groups as follows: (1) malaria and its control--11 papers including his classical studies of DDT residual spraying and its resultant effect on Anopheles albimanus behavior, as well as a scholarly 22 page treatise in "The Sardinian Project" on the concept of attempting eradication of an indigenous species; (2) yellow fever and diurnal forest mosquitoes--18 papers mainly with Pedro Galindo and Stanley Carpenter involving 6 years of arboreal mosquito studies, virus transmission experiments and epidemiological surveys of the 1948-54 Middle American YF outbreak. Included here is an important 39 page parasitological review by Trapido and Galindo "The Epidemiology of Yellow Fever in Middle America"; and (3) miscellaneous subjects--11 papers of a zoological nature concerning bats, capybaras, frogs (including descriptions of 2 new species) and a survey of West Indian phlebotomine sandflies with G.B. Fairchild.

In the early 1950s Harold was invited by the Rockfeller Foundation (RF) to act as consultant to its Sardinian malaria project, where he spent 2 summers (1950, 1952) studying the ecology of native anophelines and equating his finding with the problems and progress of the eradication effort. It was during this time that the writer and Harold strengthened their friendship. In October 1953 Trapido married Jean Litchman, a native of Seattle, WA, after which the newlyweds returned to Panama where Harold continued his YF investigation with Galindo for another 2 1/2 years.

Harold likewise became interested in the discovery of onchocerciasis in Columbia. He utilized his research and inquisitorial skills to develop an ingenious theory relating the presence of the helminths in Colombia to the importation of African slaves. Searching in the ancient Spanish archives of Popayán, Harold unearthed the manes of slaves working in the Western Cordillera and was able to relate some of said names to particular tribal areas of West Africa where onchocerciasis is endemic. These slaves, whose manes were critical to the sleuthing, were forced to work recovering gold at points where rapidly flowing streams (a source of immature simuliids) debouched onto the western coastal plain and dropped their loads of auriferous sand and gravel. The essay reflects the meticulousness observed by Harold in all his endeavors: clear presentation of the problem; accurate documentation of any historical aspects of the study, no matter how difficult to achieve; and careful thought taken to relate significant ecological and environmental characteristics to the evaluation or solution of the undertaking.

Trapido terminated his association with the RF August 31, 1970 to accept a professorship and eventually head the Department of Tropical Medicine and Medical Parasitology at the Louisiana State University School of Medicine in New Orleans, which post he held until retirement in 1984. At various times he was a member of many scientific societies both here and abroad, served with WHO expert panels on malaria and viruses, editorial and advisory boards and, in later years, was chairman of the New Orleans Mosquito Control Board, as well as a member of the Mayor's Advisory Committee on dengue.

He is survived by his wife Jean, a son, Paul Trapido of Bethesda, MD, and a brother, Joel Trapido of Hawaii.

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