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MAYOR

CITY OF NEW ORLEANS

NEW ORLEANS MOSQUITO CONTROL BOARD ANNUAL REPORT 1987

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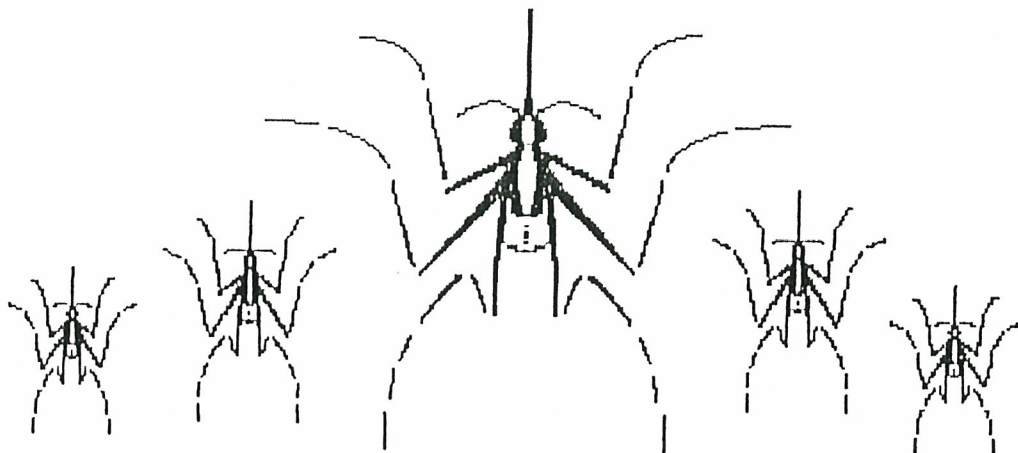
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NEW ORLEANS MOSQUITO CONTROL BOARD / EDGAR S. BORDES, JR., ADMINISTRATOR
6601 Lakeshore Drive, New Orleans, La. 70126 (on Lakefront Airport) (504-241-2370)

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graph TD
    MC3A[MOSQUITO CONTROL ADMINISTRATOR] --> AM3A[ASST. MOSQUITO CONTROL ADMINISTRATOR]
    MC3A --> ENT[ENTOMOLOGIST]
    MC3A --> SR[SR. ENTOMOLOGIST]
    AM3A --> SEC[SECRETARY]
    AM3A --> DEO[DATA ENTRY OPERATOR]
    ENT --> AV[AVIATION]
    ENT --> AUT[AUTOMOTIVE]
    ENT --> LSC[LARVAL SURVEILLANCE & CONTROL]
    ENT --> ASC[ADULT SURVEILLANCE & CONTROL]
    ENT --> SRD[SOURCE REDUCTION]
    ENT --> RES[RESEARCH & CALIBRATION]
    SR --> EBC[ENCERPHALITS SURVEILLANCE]
    SR --> CBB[CONTAINER BREEDERS/ BIOCONTROL]
    AV --> PC[PROGRAM COORDINATOR]
    AV --> APM[A&P MECHANIC III]
    AV --> CPM[CONTRACT PILOT]
    AV --> CPM2[CONTRACT A&P MECHANIC & PILOT]
    AUT --> M3[MECHANIC III]
    AUT --> M1[MECHANIC I]
    AUT --> LAB1[LABORER]
    LSC --> TAX[TAXONOMIST]
    LSC --> LSC1[M.C. INSP. II]
    LSC --> LSC2[M.C. INSP. II]
    LSC --> LSC3[M.C. INSP. II]
    LSC --> LSC4[M.C. INSP. I]
    LSC --> LSC5[SUMMER INSP.]
    LSC --> LSC6[SUMMER INSP.]
    LSC --> LSC7[SUMMER INSP.]
    LSC --> LSC8[SUMMER INSP.]
    ASC --> ASC1[M.C. INSP. II]
    ASC --> ASC2[M.C. INSP. II]
    ASC --> ASC3[M.C. INSP. I]
    ASC --> ASC4[SUMMER INSP.]
    ASC --> ASC5[SUMMER INSP.]
    ASC --> ASC6[SUMMER INSP.]
    SRD --> EOP[EQUIP. OP. IV]
    SRD --> EOP2[EQUIP. OP. IV]
    RES --> RES1[M.C. INSP. SPECIALIST]
    RES --> RES2[M.C. CHIEF]
    RES --> RES3[SUMMER INSP.]
    RES --> RES4[SUMMER INSP.]
    CBB --> CBB1[M.C. INSP. CHIEF]
    CBB --> CBB2[M.C. INSP. II]
    CBB --> CBB3[LABORER]
    CBB --> CBB4[SUMMER INSP.]
    CBB --> CBB5[SUMMER INSP.]
  
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1987
Table of Personnel

1	-	Director
1	-	Assistant Director
1	-	Aviation Program Coordinator
1	-	Senior Entomologist
1	-	Entomologist
1	-	Mosquito Control Specialist
2	-	Mosquito Control Inspector Chief
6	-	Mosquito Control Inspector II
2	-	Mosquito Control Inspector I
1	-	Secretary
1	-	Taxonomist
1	-	A & P Mechanic III
1	-	Auto Mechanic I
1	-	Auto Mechanic III
2	-	Equipment Operator IV
2	-	Laborers
10	-	Seasonal Part-time Workers

1987
Mosquito Control Equipment List

1 - 1982 4-door Ford Sedan
1 - 1979 4-door Chevrolet
1 - Aircraft, Britten-Norman BN2A-21
1 - Aircraft, Grumman
2 - Backhoes, John Deere 310
1 - Crawler, Case 350
1 - Dragline, Little Giant Amphibious
1 - Dump Truck, 1981 Ford/Diesel
1 - 1965 Ford F-250
2 - 1976 Chevy Luv Pickups
2 - 1975 GMC Pickups
6 - 1978 Ford F-100 Fog Trucks
13 - 1981 Chevy 1/2 Ton Pickups
1 - 1981 Ford F-100 Fog Truck
1 - Forklift, Caterpillar
1 - Forklift, Allis-Chalmers
1 - Track Marsh Buggy w/Ditcher
1 - Tractor Mule
2 - Utility Trailers
2 - Boat Trailers
2 - Outboard Motors - 5 & 25 hp
4 - Aluminum Flat Boats
2 - Electrical Power Plants
3 - Lawn Care Mowers
1 - Ford Tractor w/Grass Cutter

Vector mosquito surveillance and control was interrupted by the resignation of our medical entomologist, but a suitable replacement was found after a few months of searching. Our new entomologist is bi-lingual

for salinarius control. acres per flight, the Britten-Norman Islander is the ideal adulticiding mode larger than normal areas. With a treatment capability of 5,000 to 10,000 treat only during the crepuscular cycle and have the capacity to treat adulticiding tool. The key to successful salinarius adulticiding is to of this limitation the twin-engine aircraft is the most efficient active at dawn and dusk for about an hour and a half at each peak. Because to control because of its limited activity cycle. Culex salinarius are just the normal fall/winter peak. Salinarius is a very difficult mosquito due to increased Culex salinarius activity throughout the year, instead of Mosquito control activities have adjusted to additional re-direction

difficult. and control poses a unique problem and progress toward a solution has been Experimental Infections with Dog Heartworm. Aedes albopictus surveillance Blood Source on Oviposition, Light in Relation to Oviposition and Solutions on Larvae, Effect of Pupal Exuviae on Oviposition, Influence of Larvicides, Use of Sodium Chloride as a Larvicide, Effect of Acid-base Habitat Analysis, Daily Survival and Dispersal Patterns, Field Plot Tests of Jerry Freier and include the following field and laboratory studies: Larval Orleans Mosquito Control Board. Research activities are directed by Dr. Vector-Borne Viral Diseases of the Centers for Disease Control and the New Aedes albopictus is being conducted as a joint effort by the Division of Extensive research into the biology, distribution and control of

most recent adversary. Control Program to direct our efforts to the surveillance and control of our problem has prompted the staff and the board of the New Orleans Mosquito health posed by an insect in the 20th century. The serious nature of this disease transmission make this mosquito the most serious threat to human problem. Its aggressive nature in seeking blood meals and potential for of this imported mosquito species both as a pest problem and a health the United States. Mosquito Control workers are concerned about the spread continued distribution of albopictus throughout New Orleans, Louisiana and Tiger mosquito to our shores, and these same tires are responsible for the previous year. Used tire casings were responsible for delivering the Asian Aedes albopictus (the Asian Tiger mosquito) is alive and well in New Orleans and continues to maintain the territory it acquired during the

ANNUAL REPORT

Mass-rearing Toxorhynchites for use in the control of container breeding mosquitoes is reaching new plateaus. New four foot by eight foot fiberglass rearing trays are stacked eight to a column and connected

Source reduction remains the key to long-term effective mosquito control. City Park, English Turn, Eastover, Algiers and New Orleans east received most of our permanent control efforts. New water management structures and ditch maintenance projects were constructed for the purpose of eliminating the mosquito breeding habitat. With over 12,000 acres under management it is a full time job to survey and maintain the systems already in place. The W-2 wetlands project has been placed on hold pending the completion of the Bayou Sauvage National Wildlife Refuge negotiations.

Both of the NOMCB aircraft, the Britten-Norman Islander and the Grumman Ag-Cat received the 100 Hour/Annual Inspections as required for certification. Several improvements were made to the spray systems of both aircraft and several pieces of support equipment were designed and fabricated by the aviation shop. Full span wing booms were designed for the Ag-Cat and a portable chemical loading system was fabricated to service both aircraft at remote sites. Aircraft operations are extremely important to expansive, nature trails and remote subdivisions. A good part of the success of our program is due to a timely, effective, efficient aerial treatment program.

Encephalitis surveillance started in May and continued through September. There was enough encephalitis virus activity on the Gulf Coast last year for New Orleans to be at risk for an outbreak. Over 1200 birds were captured, bled and the samples were submitted to the State Laboratory for Hemagglutination Inhibition testing. There was no detectable virus activity in Orleans Parish during the past year.

Dr. G.W. Shidrawi of the World Health Organization visited our program for the specific purpose of reviewing our larval testing procedures. Dr. Shidrawi's interest is in the area of vector resistance to pesticides and his office has been receiving susceptibility data from our laboratory for the past few years. Dr. Shidrawi was in full agreement with all of our testing procedures. Other projects conducted by our laboratory included pupal susceptibility studies, Ae. albopictus surveillance and laboratory rearing of Culex salinarius and Culiseta inornata.

and is translating our video training tapes into Spanish for use in Latin America. We are now using our computers to calculate the insecticide droplet VMD and LMD to assure label compliance. We also have a program for determining the LC50 and the LC90 of our chosen adulticides against selected mosquito species. Wind tunnel evaluations against adult mosquito specimens and WHO procedures against larval mosquito specimens are ongoing and are a very important part of our program.

*Programs available in Spanish

Title	Length
1. "Yellow Fever in New Orleans 1905"	30:50
2. "The Mosquito Problem"	13:30
3. "Mosquito Control - Science at Work"	15:00
4. "Recognition and Management of Pesticide Poisoning"	15:20
5. "Fogging Procedures"	14:28
6. "Emergency Vector-Borne Disease Control"	13:30
7. "Special Photography"	9:10
8. "Spermatheca Examination in Toxorhynchites"	5:15
9. "Age Grouping of Aedes Aegypti"	17:25
10. "Adult Mosquito Identification"	30:30
11. "Wind Tunnel Testing"	27:00
12. "Aedes Albopictus: The Asian Tiger Mosquito"	23:30
13. "Old Times: A National Health and Sanitation Problem"	11:30
14. "Integrated Pest Management"	14:15

Public education, as practiced by NOMCB, is an organized, concentrated effort to change the behavior of the citizenry by the conveyance of knowledge that should lead to the elimination or reduction of specific mosquito breeding habitat. Behavior modification of adult populations is a very difficult task, so our target group is the more malleable grammar school and high school student. Video training programs are distributed to Orleans Parish Schools for use in the classrooms. To facilitate the use of these tapes a teacher's guide is included in a package with the video tape. The teacher's guide includes a good, general outline of the tape and a written test to measure comprehension by the student. Educational tapes are also provided to the School Board's Cable TV Channel, the Government Access Channel and to the Public Library. At present, the following tapes have been produced at NOMCB and copies are available:

mosquitoes is to be realized."

physical and social are mandatory if control of container breeding "Integration of control methodologies, including chemical, biological, agent in Orleans Parish. As so aptly stated in the "Tox Report" of Toxorhynchites was imported from Puerto Rico to be evaluated as a control Detailed results of these trials are included in this report. A new strain effectiveness of "Tox" against Aedes albopictus in a sylvan habitat. the coming year. Field studies were conducted to determine the screening lab is on the drawing board and construction should start during both an educational facility, teaching laboratory and as an insecticide has been in the past decade. A new mass-rearing building that will serve as effective rearing of Toxorhynchites is closer to reality this year than it together with PVC pipe to transfer prey larvae to predator larvae. Cost-

The specific purpose of this study was to determine the ability of trees and tree holes to serve as sites for the development of immature stages of Ae. albopictus. More specifically, this study was designed to measure changes in larval and pupal population densities throughout the 1987 season. By measuring the total output, or productivity, from trees and tree holes, it was hoped that this information would provide a basis for constructing predictive models that could then be used to forecast population changes. Furthermore, it was hoped that observations on developmental patterns could be correlated with certain physical and

Larval Habitat Analysis:

FIELD STUDIES:

The following information is a summary of field and laboratory activities for 1987. Technical details about each project can be found in individual monthly reports.

Research activities during this past year involved both field and laboratory projects aimed at determining the biologic attributes of Aedes albopictus mosquitoes. Some specific research goals were: (1) To determine the biological, physical, and chemical factors influencing habitat selection and, in the process, determine optimal conditions for successful development of aquatic stages. (2) To obtain information on reproduction, patterns of dispersal, and host preferences. (3) To field test chemical and biological control methods that might be used to suppress populations of the Asian tiger mosquito. And, (4) to determine the ability of this species to serve as a host and vector of infectious agents.

CDC REPORT - J.E. FREIER

The past year was filled with many firsts, but the pursuit of extramural funds was probably our most difficult and rewarding endeavor. Grants, cooperative studies and training of national and international scientists generated an increased work load that was absorbed by the staff of NOMCB. Without the dedication of such a valuable group of trained individuals we would not be able to perform our duties to the City of New Orleans and still accomplish our commitments to the private and governmental agencies that fund these many grants and proposals. Continued cooperation by the administrative and legislative branches of City Government is also a must for the Board and staff of NOMCB to continue the level of accomplishment that is expected of us. Our success is certainly a joint effort by the staff, board, City Administration, City Council and the citizens of New Orleans. We thank everyone for their cooperation.

The presence of larvae and pupae in tires is summarized in Fig. 3. The data presented here indicate that peaks of larval and pupal abundance, regardless of species, corresponded well with peaks of rainfall. Mosquito abundance peaks followed rainfall by about 7 days. The overall seasonal distribution of mosquitoes collected from 31 tires is illustrated in Fig. 4. As shown here, *Ae. albopictus* was the most abundant species found in the tires sampled. The second most common species observed was *Ae. triseriatus*; however, the incidence rate observed for this species was considerably below that shown for *Ae. albopictus*. The ratio of *Ae. albopictus* to *Ae.*

Table 1 shows the characteristics of each tire employed in this study. All were automobile tires consisting of a wide range of sizes. Tires were nearly evenly divided in terms of their exposure to sunlight.

The goals and methods of the tree hole investigation were similar to those of the tire habitat study. In the 84 acre woodlot of the Louisiana Nature and Science Center, 30 tree holes suitable for a long-term study were located and characterized. The majority of tree holes studied were not rot holes but relatively shallow pockets formed by divisions of the tree trunk. Temperature and rainfall were measured in each study site. Figure 1 depicts the temperature and rainfall patterns for this past season. While average daily temperatures were within normal ranges, rainfall, which was heavy during June, fell to near drought levels from mid-July until the end of October. The effect of rainfall on tire and tree hole habitats is shown in Fig. 2. The drought-like conditions that occurred during the latter part of summer had a pronounced effect on the ability of tree holes to serve as habitats for larval development.

In the tire habitat study, approximately 200 discarded tires were identified from 3 locations in eastern New Orleans. From this number, 31 tires were selected randomly for detailed study. Each tire was characterized in terms of its exposure to sunlight, tire size, relative amount of detritus present, water holding capacity, and water temperature. Our sampling method involved emptying the contents of each tire into a large tray. The number of larvae and their developmental stages were recorded. Mosquito pupae, other than those of *Toxorhynchites*, were removed by pipet and transferred to a tissue culture flask. Culture flasks containing pupae were returned to the laboratory where adults were allowed to emerge. Adult mosquitoes were removed daily from culture flasks and killed by freezing. The species and sex of adult mosquitoes were determined, along with the wing length of each specimen. Pupae were removed from tires twice each week, at 3 or 4 day intervals.

biological features of containers such that the optimal natural conditions for larval development could be determined. Finally, it was also hoped that this study would provide basic information on interspecific competition for the trophic resources in each type of container habitat.

Among the important questions concerning Ae. albopictus is whether adults of this species are capable of living long enough to become infected and subsequently transmit infectious agents. The probability of surviving from one day to the next is a critical component of the formula for expressing vector competence. That is, the probability of daily survival is a factor present in both the numerator and the denominator. The aim of this study was to use mark-release-recapture techniques to determine the probability of daily survival for Ae. albopictus and, at the same time, determine other biological parameters such as life expectancy, population density, rates and distances of dispersal, host choice, and the timing of reproductive events.

Daily Survival and Dispersal Patterns:

The results presented here for tire and tree hole habitats are only brief summaries of the data obtained. Information from these collections is currently being analyzed in relation to the physical and biological characteristics of each type of habitat.

Toxorhynchites mosquitoes were found in both tires and tree holes during each sampling week. Figure 7 shows that these predators were encountered more frequently in tree holes than in tires. Normally, tires containing Toxorhynchites were located in shaded areas. In addition, tree holes (Fig. 8) generally contained a greater mean number of these predators than did the tires that were studied.

Table 3 shows the characteristics of trees and tree holes employed in this study. Ninety percent of the tree holes sampled were Celtis laevigata, a species of Sugarberry which in Louisiana is commonly called Hackberry. Populations of larvae and pupae also fluctuated in response to rainfall and the pattern shown in Fig. 5 is similar to that observed for the mosquitoes in tires. The seasonal distribution of mosquitoes collected from the 30 tree holes studied is shown in Figure 6. Aedes triseriatus was the most abundant mosquito species obtained from tree holes; however, the most striking feature was the low number of Ae. albopictus specimens that were collected. These results are in sharp contrast to a survey conducted in September, 1986, in which 37 tree holes were sampled from this same site and nearly three-fourths (73%) of the tree holes examined contained Ae. albopictus larvae. Table 2 shows the ratio of Ae. albopictus to Ae. triseriatus obtained from tree holes.

Other mosquito species found in the tires studied were Culex quinquefasciatus, Culex restuans, Orthopodomyia signifera, Anopheles punctipennis, Anopheles crucians and Toxorhynchites rutilus septentrionalis. An important note here is that no specimens of Aedes aegypti were collected in spite of the fact that 1986 records showed this species to be present in the vicinity of all 3 study sites.

This study was conducted in a 5-acre woodlot located on Grant Street in eastern New Orleans. A vegetational analysis of this densely wooded tract showed that it was once part of a cypress swamp, but now 98 percent of the plant bio-mass consists of Chinese tallow trees. Numerous tires and other artificial containers scattered around the periphery of the release site (Fig. 9) provided a high density and wide diversity of breeding habitats. Field studies at this Grant Street location in 1986 showed that *Ae. albopictus* was highly abundant throughout the woodlot.

During April, 1987, we initiated a colony of mosquitoes derived from adult females collected along Grant Street. Every 2 to 3 weeks, depending on individual experimental designs, approximately 3,000 virgin male and 3,000 virgin female mosquitoes were marked and released. Immediately prior to dusting, an aliquot of males and females were removed from cages and held separately in the insectary as unmarked controls. Mosquitoes were then marked with either an orange or chartreuse colored fluorescent dust. Colors were alternated such that the same color was not repeated until after 4 or more weeks. Also, an aliquot of males and females were removed from cages, immediately after dusting, and placed in the insectary to serve as survival controls for the dusting procedure. Dusted mosquitoes were transported to the release site and cages were opened at a point in the center of the sampling area. After release, resting and host seeking mosquitoes were recaptured using a backpack aspirator. Recaptures were generally made between 8 and 11 AM. Some recaptures were made along a concentric path (Fig. 9) at varying distances from the release point. In addition, some recaptures were made at several fixed stations located within the study site.

Captured mosquitoes were returned to the laboratory, killed by freezing, and examined under long wavelength ultraviolet light. Marked mosquitoes caught at each recapture distance were separated from unmarked ones. All marked and unmarked specimens were frozen for later dissection and examination.

Overposition within the study area was monitored by placing ovitraps at each distance sampled. Also, daily mean, maximum, and minimum temperatures were recorded, as well as relative humidity and the amount of daily rainfall.

More than 56,000 marked mosquitoes (Table 4) were released in 10 separate experiments conducted between May 13th and mid-October. Although the combined number of recaptured males and females were quite similar, the recapture rates varied among different experiments. Some of this variation was due to changes in the recapture interval, while other recaptures were reduced because of adverse weather conditions.

The study site for field plot tests was located in the fringe area of a 10 acre woodlot in eastern New Orleans. For each investigation, approximately 100 recently discarded tires were brought to the test site, divided randomly into equal numbers, and arranged into two piles. Both piles were located in shaded open areas. Tires were allowed to become naturally infested from an abundant population of *Ae. albopictus* present in the woodlot. After 4 weeks exposure to the natural population of mosquitoes, the treatment experiment was begun. However, prior to insecticide application, 20 tires from various locations within each pile were numbered. From this group of 20 marked tires, 10 casings were selected randomly for detailed study. Immediately prior to application of the larvicide to be tested, the contents of each selected tire were removed. The number and developmental stage was determined for each immature mosquito present. The formulation of permethrin applied was a sandcore granule preparation containing 1.5% active ingredient. The material that we used is marketed under the trade name Pounce and is used for the control of earworms on corn. Application was performed with a manually operated Seymour Universal spreader. The dosage of larvicide that a treatment area received was monitored by catching dispersed granules through two methods: First, the mass of granules received by the treated area was determined by placing 5 aluminum pans in various positions within the tire pile. Secondly, the amount of insecticide entering tires was estimated by collecting granules from 5 clean and dry tires arranged systematically within the tire pile.

Field Plot Tests of Larvicides:

Table 5 shows a summary of daily survival probabilities obtained from the experiments conducted. The low PDS value on release 3 may have been due to excessive rainfall, since the week of June 10th was the wettest one of the season. The low survival rate estimate for release 7 cannot be explained as yet. However, the overall average probability of daily survival was 0.77 for both males and females.

Figures 10 - 19 show the regression lines for males and females recaptured in ten mark-release-recapture experiments. Although there was some variability in the numbers recaptured from experiment to experiment, the slopes of the recaptures for most experiments were quite similar.

Calculations of daily survival probability were performed with the assumption that the daily survival rate was constant during each recapture interval. Daily survival was estimated by regressing the $\log_{10}$ of the number of recaptures plus one on the number of days after release. The antilog of the regression coefficient yielded the daily survival rate. Also, a t-test was performed to test for significant departure of the regression line slope from zero. In addition, the average life expectancy was calculated from the reciprocal of the negative natural log of the probability of daily survival.

The effect of Bti-fenoxycarb on oviposition is shown in Table 10. Treated tires received more eggs per oviposition than tires in the untreated group for the first two sampling weeks. This situation was reversed during the last two sampling weeks when the treated tires appeared to be less attractive. Overall, however, no consistent trends were shown.

A field plot test of a combination of Bti and fenoxycarb was also performed. The rationale for using this combination was that Bti might provide an immediate kill of larvae in tires, while fenoxycarb, acting as an insect growth regulator, might persist to prevent emergence of adults from pupae that developed during subsequent hatches of eggs. The insecticide used was a granular formulation in which 200 ITU's of Vectobac Bti and 1.0% fenoxycarb were impregnated on corn cob material. The procedure for this test was similar to that used in the permethrin experiment. Approximately 3.0% of the granules applied entered tires and the mean weight of granules received by each tire was 5.8 grams. Results of the bioassays are shown in Table 9. Bioassays were conducted until 81 days posttreatment. Mortality for larvae in the treated group exceeded 80% at 60 days, but fell to 9% at 81 days.

The effect of permethrin on oviposition is shown in Table 8. As shown here, an average reduction in oviposition of about 90 percent below that observed in the treated tires.

The results shown in Table 6 indicate that each study tire in both treated and untreated groups contained *Ae. albopictus* larvae. All larvae and pupae that naturally infested the treated tires were killed within 24 hours of insecticide application. Bioassays continued for 121 days (Table 7) and, throughout this time, mortality was nearly 100 percent for larvae in the treated group.

Results from monitoring the insecticide application indicated that only 1.2 percent of the granules applied actually entered tires and the mean weight received by each tire was 8.0 grams. Immediately after treatment, bioassay cages containing 20 laboratory reared 4th instar *Ae. albopictus* larvae were placed in each study tire of both treated and untreated groups. At the time bioassay larvae were examined after an exposure of 24 hours. Also, a fiberboard oviposition strip was attached to the inside of each study tire. Air and water temperatures, in addition to rainfall, were monitored during this study.

LABORATORY STUDIES:

Effects of Sodium Chloride:

The toxicity of sodium chloride solutions to 4 species of mosquitoes was measured. The species tested were *Ae. aegypti*, *Ae. albopictus*, *Ae. vexans*, *Cx. quinquefasciatus*. Fourth instar larvae of each species were tested and those of *Ae. albopictus* were the most capable of surviving saline conditions. The LC_{50} and LC_{90} levels were 15.1 and 18.9 parts per thousand (ppt) respectively. Pupae of *Ae. albopictus* were also tested, but no mortality was observed even when the salt concentration was increased to 35 ppt. However, sodium chloride did have a pronounced effect on egg hatching. As shown in Fig. 20, a salt concentration of about 0.5 ppt resulted in a 50 percent reduction in the number of eggs hatched. Sensitivity to increasing salt concentrations was also shown in an experiment to measure the effect on oviposition. The results showed that as the concentration increased, the number of eggs oviposited decreased. However, greater than half of the total number of eggs collected were laid in containers with saline concentrations ranging up to 10 ppt.

Effect of Acid-base Solutions:

Results of tests to measure the tolerance of fourth instar larvae to acid-base solutions showed that significant mortality levels were observed only when the acid pH was 2.0 or less, or when the alkaline pH was 12.0 or greater. Experiments designed to measure the effect of acid-base solutions on oviposition showed that the preferred pH range was from 6.0 to 11.0. The largest percentage of eggs was laid in the pH 8.0 container (23.9%). In addition, nearly two-thirds of all eggs laid were in jars containing alkaline solutions.

Effect of Pupal Exuviae on Oviposition:

The influence of pupal exuviae on oviposition by *Ae. albopictus* females was studied in an experiment in which varying numbers of either male or female exuviae were placed in an oviposition container. Gravid females were allowed to lay eggs in the randomly arranged jars. The numbers of exuviae per container used in this test were 0 (control), 1, 5, 10, 25, and 50. The results of 3 replicates showed that the presence of exuviae belonging to either sex did not significantly influence the selection of that vessel as an oviposition site.

Influence of Blood Source on Oviposition:

Groups of *Ae. albopictus* females were allowed to feed on one of several different blood hosts in an experiment designed to measure the effect of blood source on the number of eggs that are produced and oviposited. Only females in their first gonotrophic cycle were used. The results showed that mosquitoes feeding on all of the rodent species (gerbil, hamster, mouse) laid significantly more eggs than those feeding on either avian, lagomorph, or human hosts. Mean numbers of eggs from chicken and

house sparrow hosts did not differ significantly; however, egg numbers from a human host were significantly less than those obtained from a chicken host and all of the rodent species. Egg numbers from a human host were significantly below those obtained from all other species, except human.

Light in Relation to Oviposition:

Two experiments were conducted in which gravid Ae. albopictus mosquitoes were provided ovipositional sites at 2 different light intensities. When females were offered a choice of containers at 1 and 11 footcandles, nearly two-thirds of all eggs collected were laid on ovistraps in the 1 footcandle group. However, when the light intensity was increased and the comparison became 1 and 30 footcandles, 88.3 percent of the eggs were laid on the strips at the lower light intensity.

Experimental Infections with Dog Heartworm:

In collaboration with Dr. Robert C. Lowrie of the Tulane Primate Center, several experiments were conducted to determine whether North American strains of Ae. albopictus are capable of serving as hosts for Dirofilaria immitis larvae. Aedes albopictus strains from HOUSTON, MEMPHIS, and NEW ORLEANS were tested along with two known susceptible species, Ae. aegypti LIVERPOOL and Ae. taeniorhynchus VERO BEACH. Canine blood containing microfilaria of D. immitis was obtained from an infected dog housed in a vivarium at the Tulane University Medical School. Five-day-old mosquitoes were fed infected blood under *in vitro* conditions. After allowing groups of mosquitoes to feed for 30 minutes, engorged females were transferred to separate cages and incubated for 14 days at 27° C. Immediately after feeding, five females from each group were examined to determine the average uptake of microfilaria. In addition, daily survival for mosquitoes feeding on the blood-parasite mixture was compared with survivorship among unfed control groups.

A summary of data obtained from dog heartworm experiments conducted in 1987 is shown in Table 11. In 3 experiments, the concentration of microfilaria in the blood mixture was increased from 36 to 70 to 125 mf/20 μ l blood. However, the number of microfilaria ingested did not increase correspondingly. Although some increased ingestion of microfilaria was noted for Ae. taeniorhynchus when the parasite density was doubled between experiments 1 and 2, the number ingested actually decreased in experiments 2 and 3 when the microfilaria concentration was increased by nearly 80 percent. Mortality rates for Ae. albopictus females that fed on infected blood did increase with each experiment, but the reverse was observed for Ae. taeniorhynchus. In spite of these unexplained observations, comparisons of infectivity rate, as a measure of host efficiency, showed that the MEMPHIS strain was about as efficient as the known natural and experimental vectors of dog heartworm.

Table 1. Characteristics of tires studied in New Orleans in 1987.

Tire no.	Location	Tire type	Tire brand	Tire size	Sun/shade	Light intensity (fc)	Max vol (L)	Detritus (g)
1		A	US Royal	7.75-14	shade	300	3.6	7.1
2		A	US Royal	E 50-14	shade	320	5.6	5.7
3		A	Firestone	7.00-13	shade	270	3.0	6.7
4		A	Autoflight	J 78-14	shade	450	5.4	7.2
5		A	Uniroyal	70-OR-15	sun	4200	4.2	2.9
6		A	Uniroyal	E 78-14	sun	3900	3.0	0.8
7		A	Firestone	7.50-16	sun	4100	8.0	1.8
8		A	Sears-Allstate	8.25-15	sun	3000	4.6	4.3
9		A	Sears-Allstate	8.25-14	sun	4000	3.0	1.8
10		A	Dunlop	E 78-14	sun	4000	3.6	1.5
11		A	Goodyear	H 78-14	sun	4100	2.0	7.5
12		A	Gibson	E 78-14	shade	125	3.6	8.9
13		A	Atlas	G 78-15	shade	240	3.6	8.2
14		A	Dunlop	185-70-14	sun	3800	4.0	1.4
15		A	Allroad	75 B 15	sun	3800	5.8	1.1
16		A	Atlas	700-15 LT	shade	420	7.8	0.9
17		A	Firestone	75 R 15	sun	4000	6.0	1.0
18		A	Star Centurian	80 R 13	sun	3200	3.6	0.6
19		A	Delta Ranger	75 B 15	sun	2800	5.0	1.3
20		A	Sears	R 78 15	sun	3800	3.7	1.0
21		A	Goodyear	H 78 15	shade	120	4.8	9.9
22		A	Goodyear	75 R 15	shade	125	4.0	1.1
23		A	General Tire	75 R 15	sun	4000	5.0	5.9
24		A	Sears	75 R 15	sun	4100	5.0	3.0
25		A	Gillette	75 B 14	shade	100	4.0	10.8
26		A	Road Hugger	G 60 15	shade	110	4.0	14.4
27		A	Penn. Turnpike	G 78 14	shade	130	6.1	7.3
28		A	Goodyear	H 78 15	shade	47	6.0	4.2
29		A	Mitchell	225 15 X	shade	65	8.4	5.4
30		A	All American	G 60 14	sun	3900	5.4	1.2
31		A	BF Goodrich	60 R 15	sun	4200	3.0	2.7

Table 2. Ratio of Ae. albopictus to Ae. triseriatus obtained from tire and tree hole habitats.

Sampling week			Ratio of <u>albopictus</u> to <u>triseriatus</u>	
			Tires	Tree holes
May 24			3.6:1	---
31			4.3:1	---
June 7			1.5:1	---
14			3.5:1	1.10:1
21			2.7:1	0.04:1
28			1.6:1	0.05:1
July 5			10.0:1	0.32:1
12			3.1:1	0.29:1
19			3.5:1	---
26			29.7:1	---
August 2			3.2:1	---
9			17.8:1	1.90:1
16			5.4:1	0.22:1
23			9.5:1	---
30			---	---
September 6			---	---
13			3.1:1	10.0:1
20			6.5:1	5.6:1
27			---	---
October 4			---	---
11			---	---
18			---	---
25			---	---

Table 3. Characteristics of trees and treeholes being studied at the Louisiana Nature and Science Center as larval habitats for *Aedes albopictus*.

Treehole no.	Species	Tree			Treehole
		Height (m)	Girth (m)*	Height (m)	Depth (cm)
1	Sugarberry	13.7	1.6	0.5	10.2
2	Red Maple	18.9	2.6	1.2	7.1
3	Sugarberry	15.2	1.4	<0.1	10.2
4	Sugarberry	10.6	1.1	1.5	7.6
5	Sugarberry	12.2	1.3	1.2	8.3
6	Sugarberry	19.8	1.8	1.2	10.2
7	Sugarberry	16.8	1.5	1.5	10.2
8	Red Maple	12.2	1.4	2.0	17.8
9	Sugarberry	19.8	2.1	1.7	7.6
10	Sugarberry	19.8	2.0	1.7	7.6
11	Sugarberry	18.9	2.0	0.3	16.5
12	Sugarberry	14.6	1.9	1.3	8.9
13	Sugarberry	14.6	2.5	0.9	17.8
14	Sugarberry	13.7	1.6	0.9	7.6
15	Sugarberry	14.3	2.1	0.3	6.4
16	Sugarberry	17.7	2.0	0.7	20.3
17	Red Maple	11.0	0.8	0.7	11.4
18	Sugarberry	21.3	2.4	0.5	8.9
19	Sugarberry	18.3	1.8	1.5	9.7
20	Sugarberry	15.2	1.5	0.8	7.6
21	Sugarberry	15.2	1.5	0.9	16.5
22	Sugarberry	15.8	2.3	1.2	10.2
23	Sugarberry	19.8	1.5	2.1	17.8
24	Sugarberry	13.7	1.5	0.9	16.5
25	Sugarberry	16.8	2.2	0.9	5.1
26	Sugarberry	15.2	1.9	1.1	6.4
27	Sugarberry	13.7	1.1	1.5	8.9
28	Sugarberry	15.2	1.0	0.8	6.4
29	Sugarberry	16.7	2.1	0.1	7.6
30	Sugarberry	18.3	1.6	2.1	8.9

* Tree girth was measured at a height of 1 meter.

Table 4. Numbers of *Aedes albopictus* released and recaptured in 1987.

Release no.	Date	No. released		No. recaptured (%)	
		males	females	males	females
1	May 13	1,938	1,079	244 (12.6)	35 (3.2)
2	May 27	2,066	2,532	344 (16.2)	311 (12.3)
3	June 10	2,760	3,037	3 (0.1)	190 (6.3)
4	June 24	3,219	2,913	364 (11.3)	183 (6.3)
5	July 8	2,842	3,332	394 (13.9)	382 (11.5)
6	July 22	3,477	3,104	694 (20.0)	445 (14.3)
7	August 5	3,303	2,673	758 (22.9)	853 (31.9)
8	August 19	3,143	2,731	134 (4.3)	55 (2.0)
9	Sept. 9	3,320	3,626	36 (1.1)	64 (1.8)
10	Sept. 20	2,741	2,612	42 (1.5)	75 (2.9)
Totals		28,809	27,639	3,013 (10.5)	2,593 (9.4)

Table 5. Probabilities of daily survival for *Aedes albopictus* from mark-release-recapture experiments in 1987.

Release no.	Date	PDS		ALE (days)	
		males	females	males	females
1	May 13	0.77	0.82	3.8	5.0
2	May 27	0.79	0.81	4.2	4.8
3	June 10	NA	0.62	NA	2.0
4	June 24	0.77	0.79	3.8	4.2
5	July 8	0.83	0.80	5.3	4.5
6	July 22	0.78	0.80	4.0	4.5
7	August 5	0.60	0.62	2.0	2.1
8	August 19	0.88	0.88	7.8	7.8
9	September 9	0.83	0.78	5.4	4.0
10	September 20	0.72	0.77	3.0	3.8

Table 6. Composition of mosquito species in tires at the onset of the permethrin test.

Tire group	n	Species	Mean no. larvae/pupae per tire	Percent of tires
Treated	10	<u>Ae. albopictus</u>	18.2	100.0
		<u>Ae. triseriatus</u>	0.6	30.0
		<u>Tx. rut. sept.</u>	1.7	1.7
Untreated	10	<u>Ae. albopictus</u>	67.9	100.0
		<u>Ae. triseriatus</u>	7.6	70.0
		<u>Tx. rut. sept.</u>	0.6	30.0

Table 7. Results of bioassays for permethrin toxicity.

Days post-treatment	No. larvae dead/total		No. larvae in treated tires	
	Treated	(% mortality)	Untreated	(% mortality)
1	200/200	(100.0)	0/200	(0.0)
3	200/200	(100.0)	0/200	(0.0)
7	193/200	(96.5)	0/200	(0.0)
11	195/200	(97.5)	0/200	(0.0)
15	192/200	(96.0)	0/200	(0.0)
19	172/200	(86.0)	0/200	(0.0)
22	193/200	(96.5)	0/200	(0.0)
27	197/200	(98.5)	0/200	(0.0)
31	200/200	(100.0)	0/200	(0.0)
35	200/200	(100.0)	0/200	(0.0)
42	200/200	(100.0)	0/200	(0.0)
49	200/200	(100.0)	0/200	(0.0)
56	190/200	(95.0)	0/200	(0.0)
70	200/200	(100.0)	0/200	(0.0)
78	190/200	(95.0)	0/200	(0.0)
86	200/200	(100.0)	0/200	(0.0)
93	200/200	(100.0)	0/200	(0.0)
100	200/200	(100.0)	4/200	(2.0)
107	200/200	(100.0)	4/200	(2.0)
121	200/200	(100.0)	8/200	(4.0)

Table 8. Effect of permethrin on mosquito oviposition in tires.

Egg collection interval	Mean no. eggs/ovistrip*		Percent reduction
	Treated	Untreated	
Aug. 5-12	2.7	168.2	98.4
Aug. 12-19	19.6	170.9	88.5
Aug. 19-26	9.7	100.0	90.3
Aug. 26-Sept. 2	14.1	78.4	82.0
Sept. 2-9	13.7	74.1	81.5
Sept. 9-16	10.5	107.5	90.2
Sept. 16-23	7.9	82.1	90.3
Sept. 23-30	3.0	23.2	89.1
Sept. 30 - Oct. 7	4.8	75.9	93.7
Oct. 8 - 15	0.0	19.9	100.0
Oct. 15 - 22	0.0	18.3	100.0
Oct. 22 - 29	0.0	29.5	100.0
Oct. 29 - Nov. 4	0.0	0.5	100.0
Nov. 4 - 11	0.0	0.0	---
Nov. 11 - 19	0.0	0.0	---

* Ten ovistrips from each group were examined.

Table 9. Results of bioassays for Bti-fenoxycarb toxicity.

Days post-treatment	No. larvae dead/total		
	Treated	(% mortality)	Untreated (% mortality)
1	178/200	(89.0)	0/200 (0.0)
4	161/200	(80.5)	0/200 (0.0)
8	166/200	(83.0)	0/200 (0.0)
12	179/200	(89.5)	0/200 (0.0)
18	168/200	(84.0)	28/200 (14.0)
22	199/200	(99.5)	18/200 (9.0)
26	197/200	(98.5)	0/200 (0.0)
32	198/200	(99.0)	28/200 (14.0)
39	173/200	(86.5)	0/200 (0.0)
46	164/200	(82.0)	1/200 (0.5)
53	180/200	(90.0)	10/200 (5.0)
60	168/200	(84.0)	29/200 (14.5)
67	73/200	(36.5)	29/180 (16.1)
81	18/200	(9.0)	23/200 (11.5)

Table 10. Effect of Bti-fenoxycarb on mosquito oviposition in tires.

Egg collection interval	Mean no. eggs/ovistrip*	
	Treated	Untreated
Sept. 10-18	79.8	24.8
Sept. 18-25	56.8	34.1
Sept. 25 - Oct. 2	78.8	113.6
Oct. 2-9	19.0	36.4
Oct. 9-16	28.6	16.4
Oct. 16-23	NA	NA
Oct. 23-30	19.2	45.0

* Ten ovistrips from each group were examined.

Table 11. Summary of experimental infections of *Ae. albopictus* with *Dirofilaria immitis* during 1987.

Species/strain	Exp. no.	Parasite density (mf/20 µl)	Mean no. mf ingested	Percent mortality	Percent infected	Infectivity rate in percent
<i>Ae. albopictus</i>						
HOUSTON	1	36	0.8	75.5	0.0	—
MEMPHIS	1	36	1.2	36.5	32.0	23.0
	2	70	2.8	49.4	18.0	13.6
	3	125	0.6	53.9	10.5	38.0
NEW ORLEANS	1	36	3.0	31.6	16.0	4.0
	2	70	3.0	49.0	6.0	2.7
	3	125	4.0	53.3	20.0	7.0
<i>Ae. aegypti</i> LIVERPOOL	1	36	5.4	63.9	44.0	21.0
<i>Ae. taeniorhynchus</i> VERO BEACH						
	1	36	2.0	66.1	72.0	70.0
	2	70	14.4	44.6	80.0	13.3
	3	125	10.2	33.6	92.0	26.1

FIGURE 1

METEOROLOGICAL DATA New Orleans - 1987

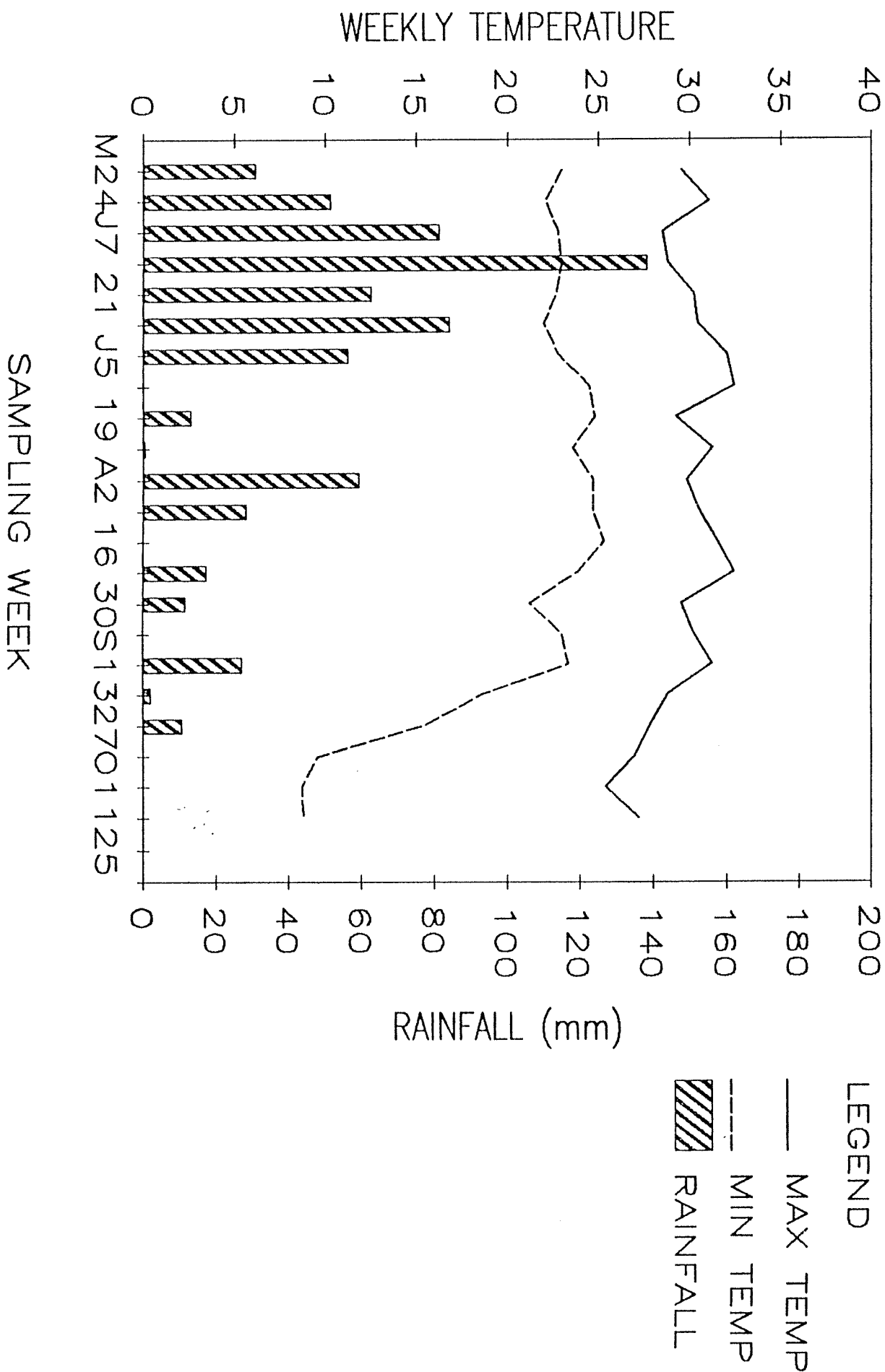
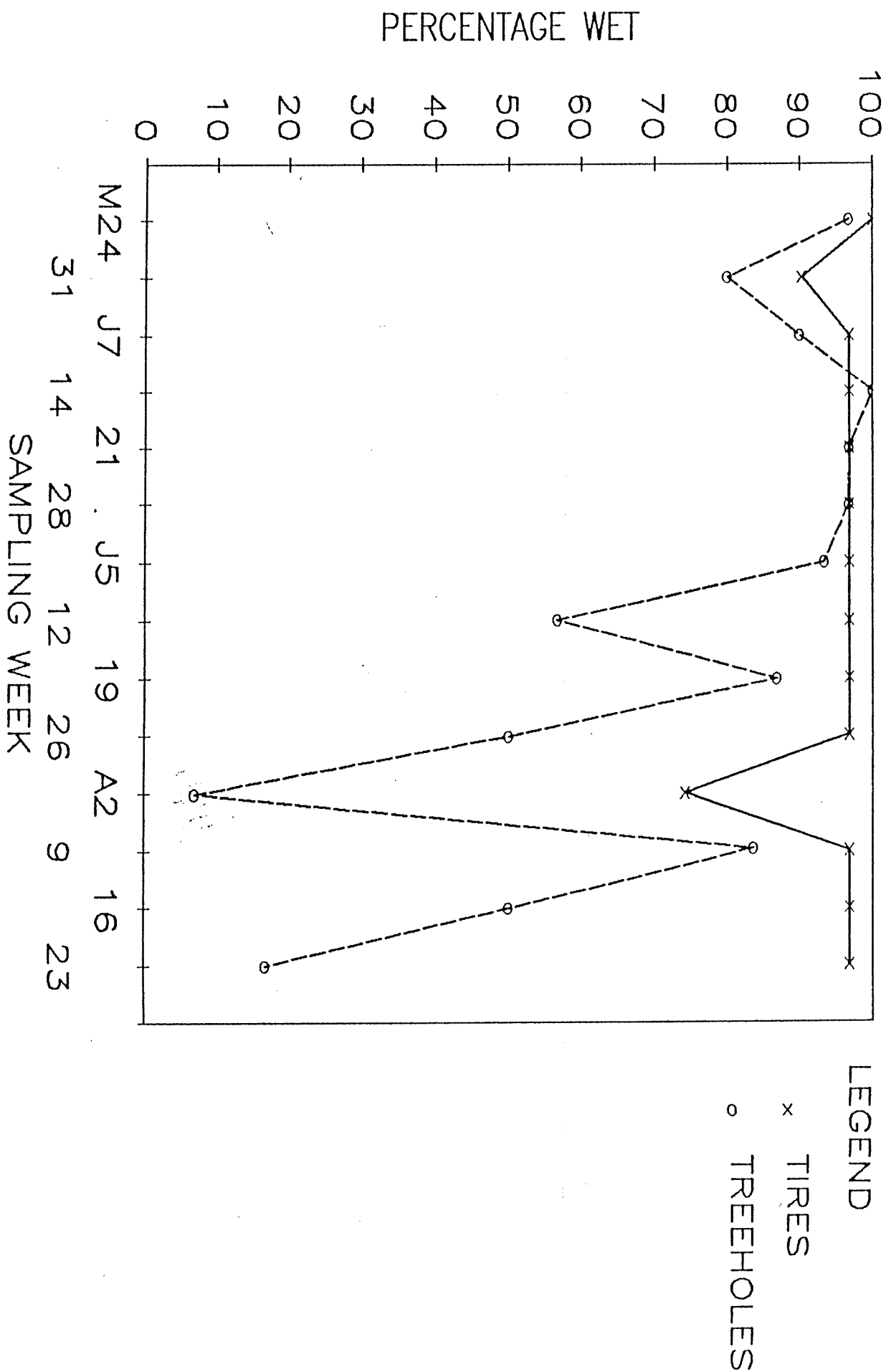


FIGURE 2

TIRES AND TREEHOLES WITH WATER



MOSQUITO LARVAE AND PUPAE IN TIRES 1987

FIGURE 3

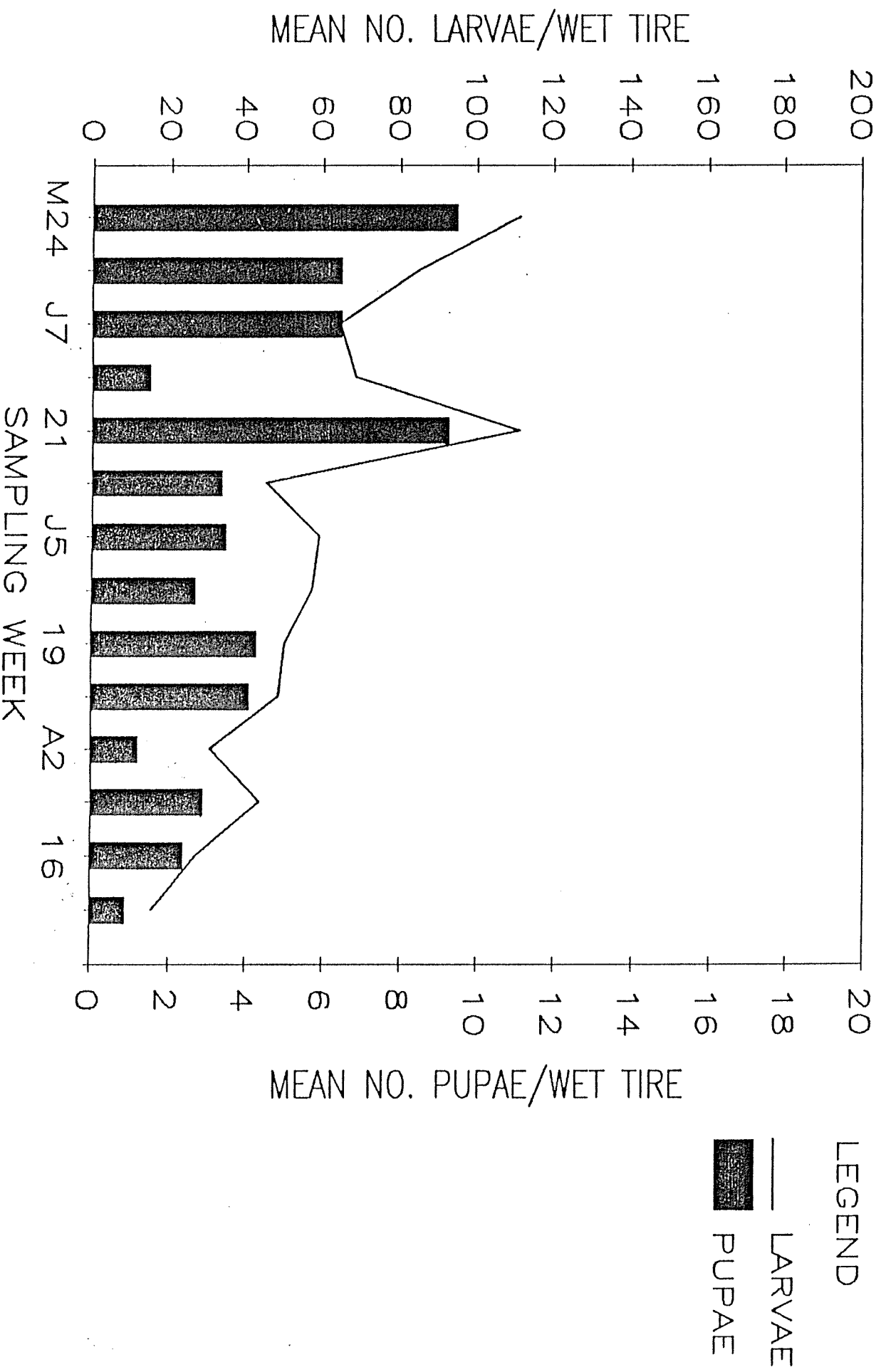


FIGURE 4

SEASONAL DISTRIBUTION OF MOSQUITOES COLLECTED FROM 31 TIRES IN 1987

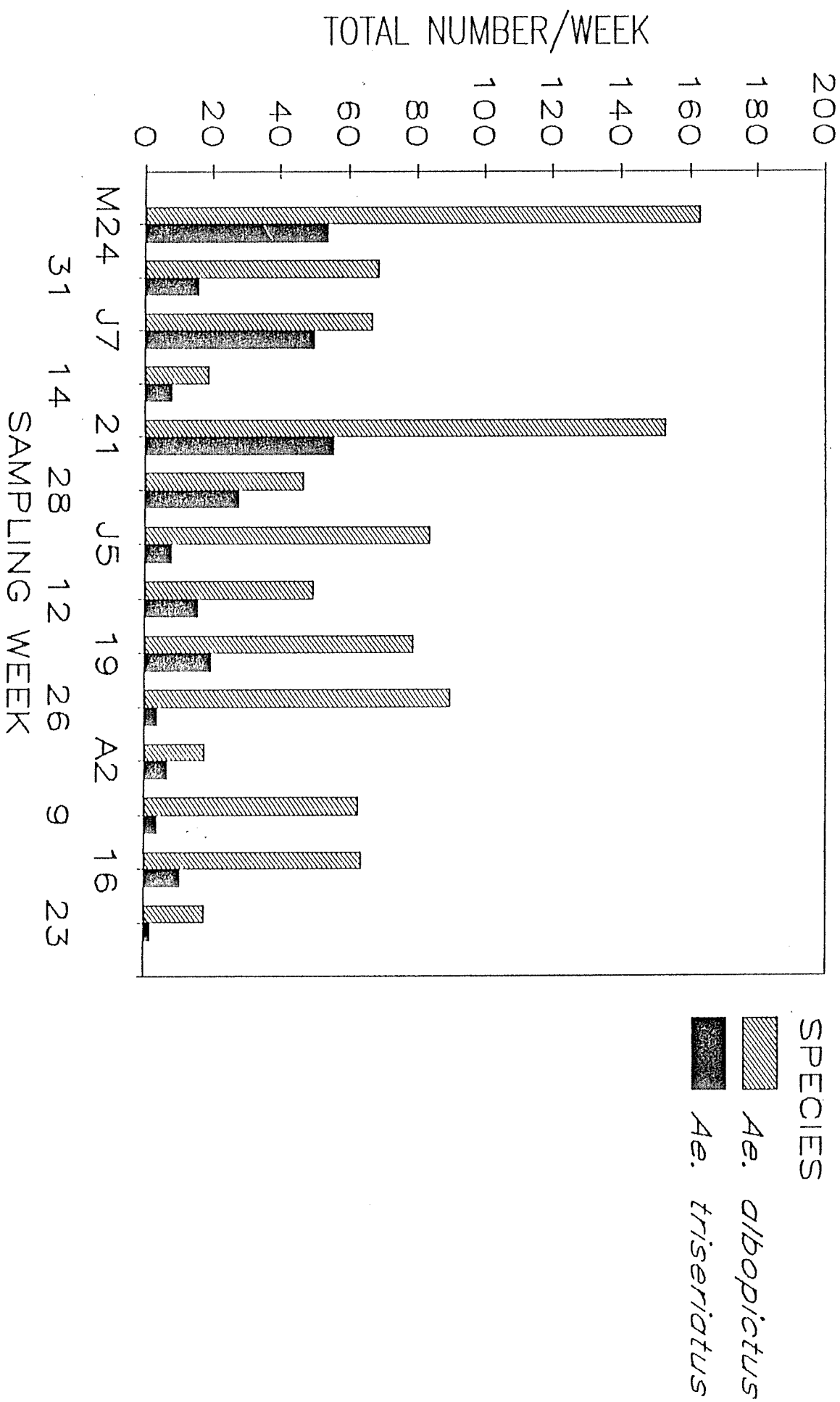


FIGURE 5

MOSQUITO LARVAE AND PUPAE IN TREE HOLES 1987

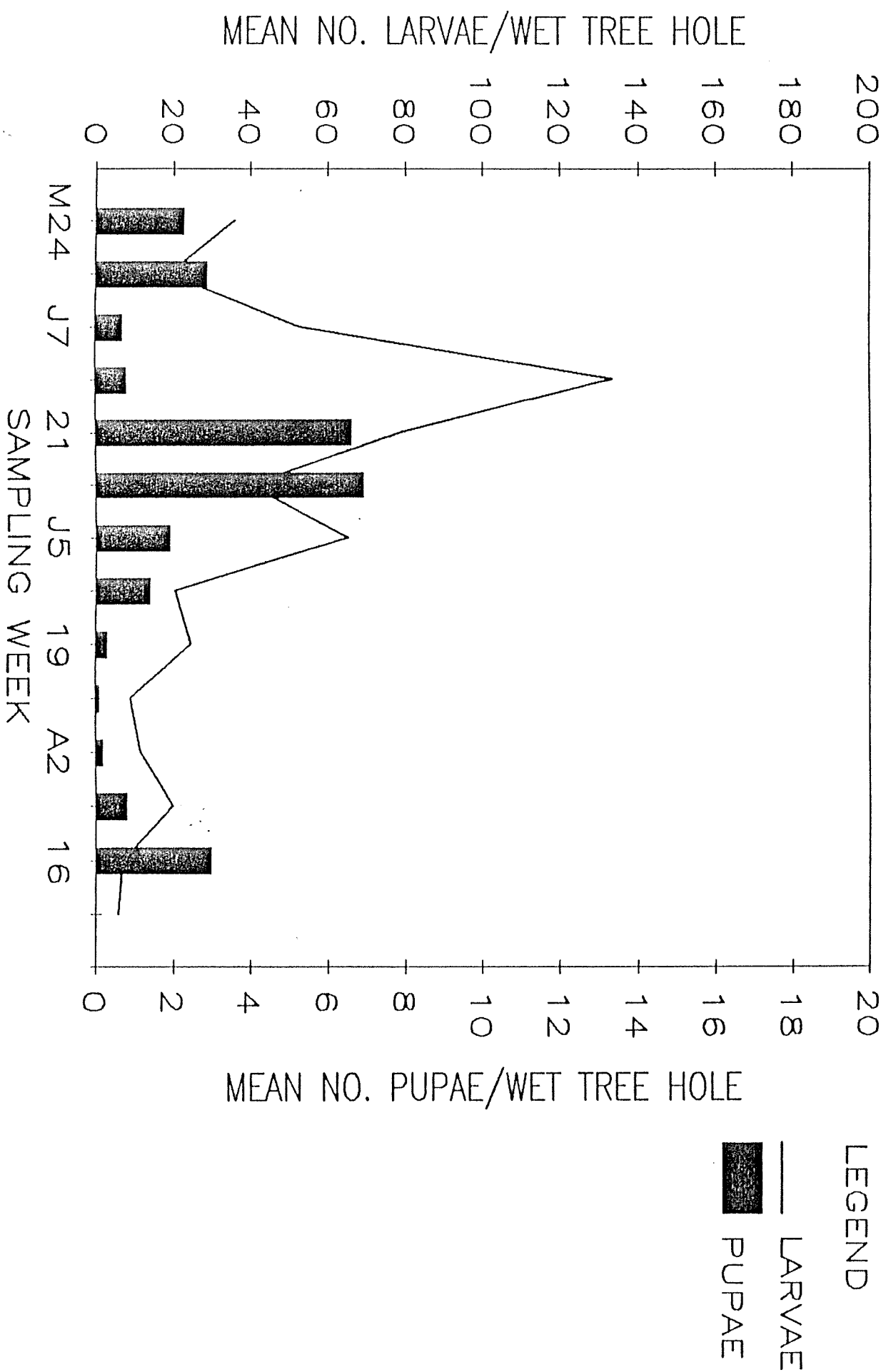


FIGURE 6

SEASONAL DISTRIBUTION OF MOSQUITOES COLLECTED FROM 30 TREEHOLES IN 1987

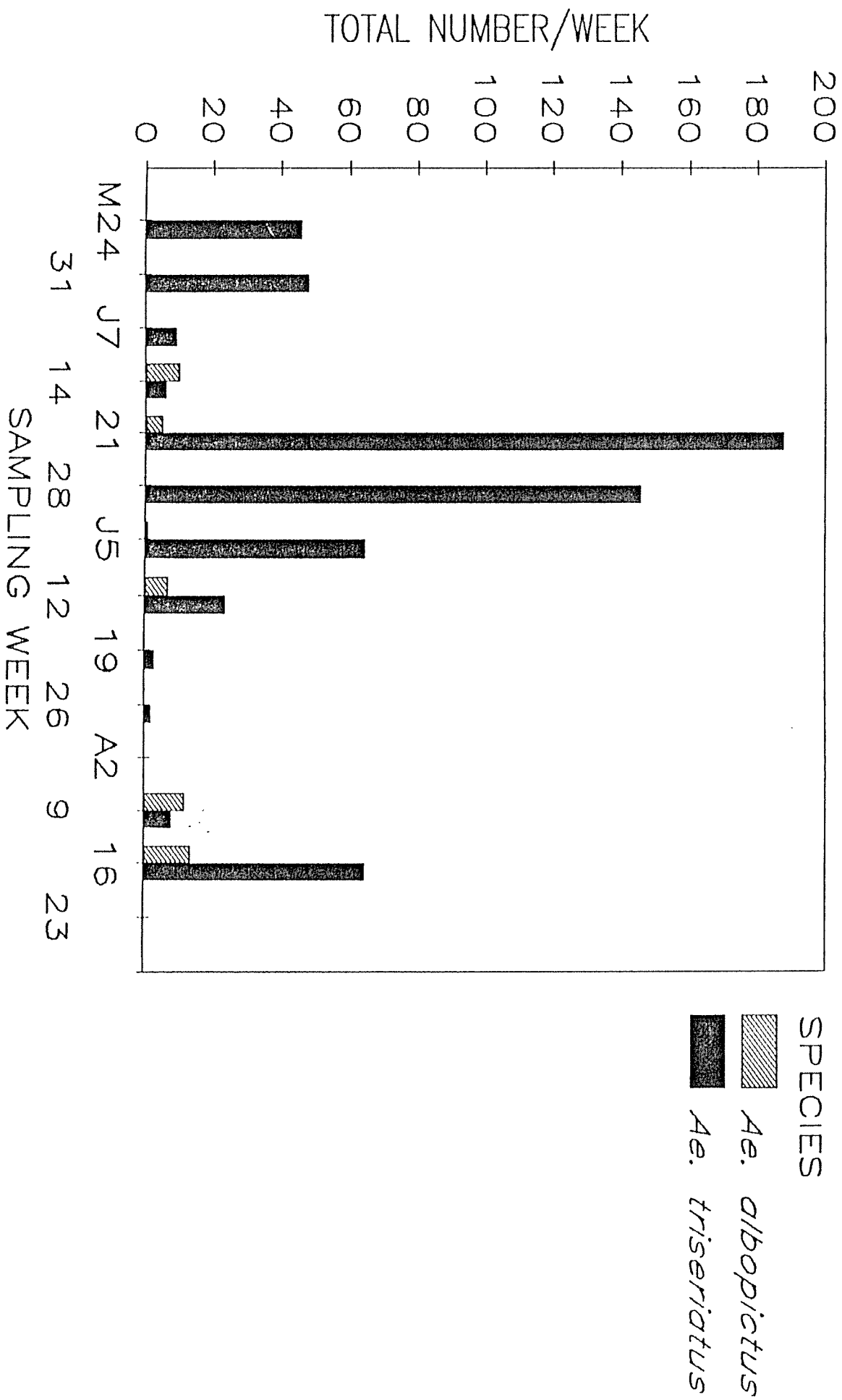


FIGURE 7

PERCENTAGE TIRES AND TREEHOLES WITH *TOXORHYNCHITES RUTILUS SEPTENTRIONALIS*

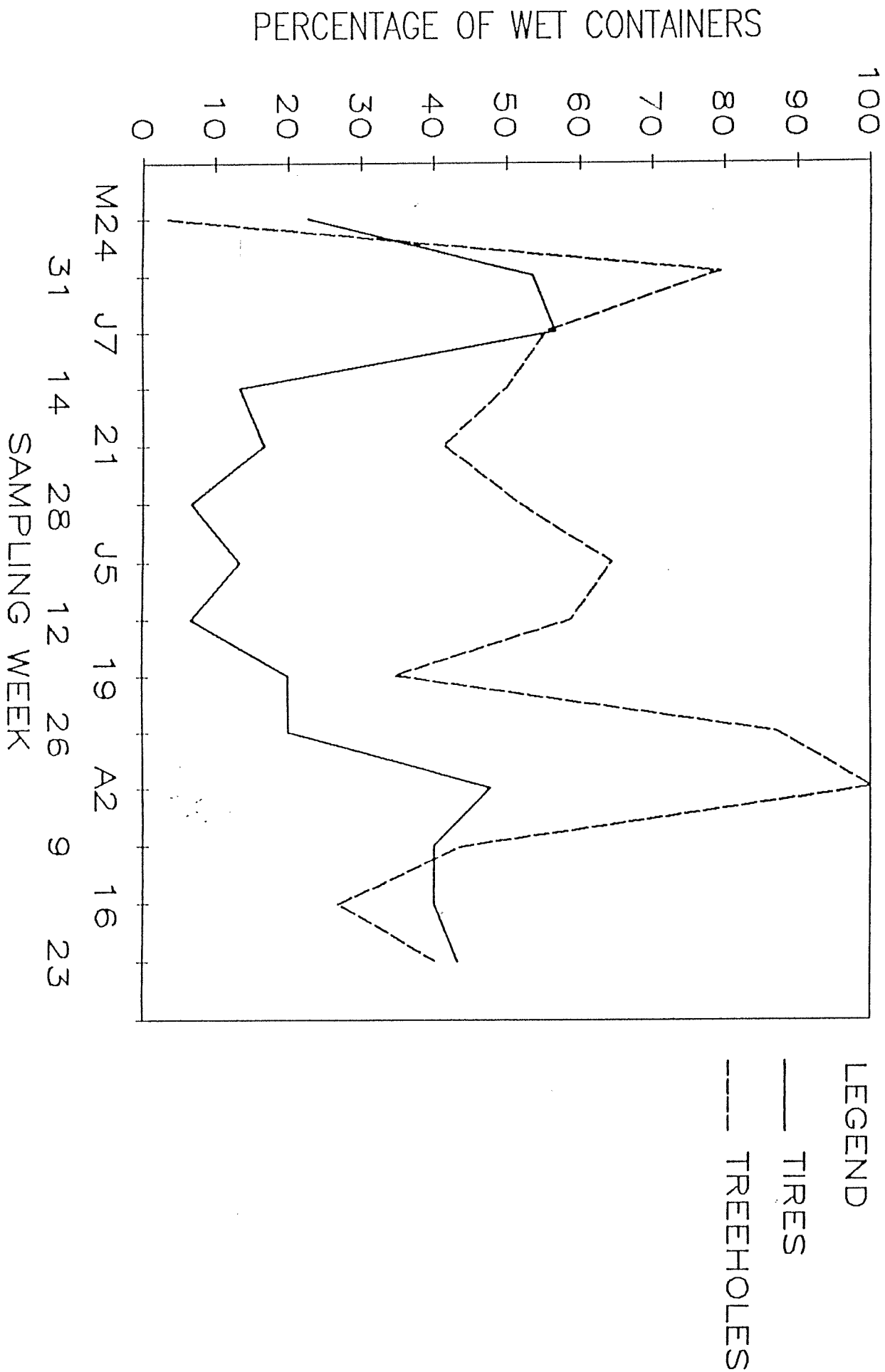


FIGURE 8

TOXOPHYMCHITES RUTILUS SEPTENTRIONALIS IN TIRES AND TREEHOLES

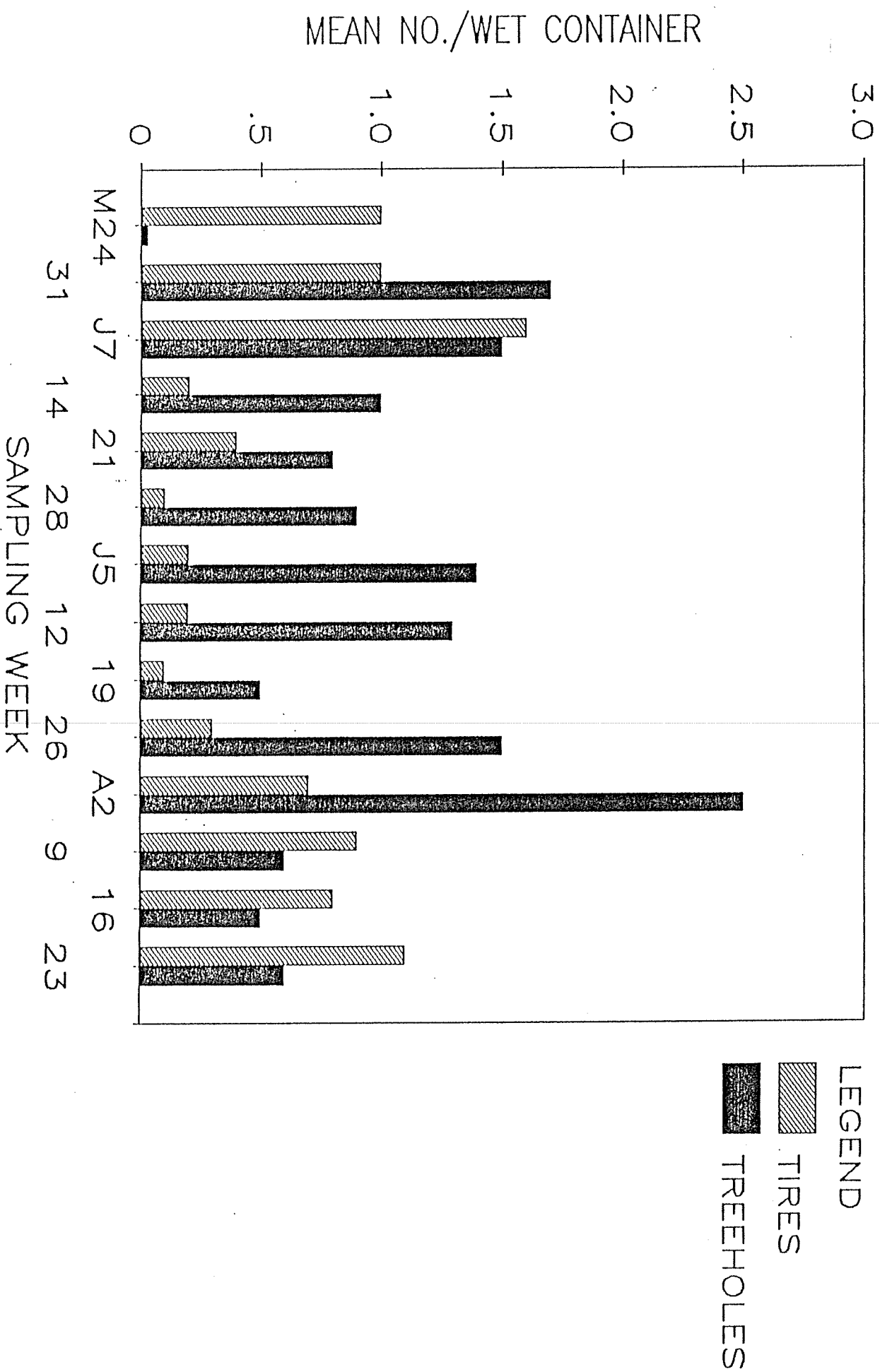


Figure 9

GRANT STREET
MARKED-RELEASE-RECAPTURE SITE

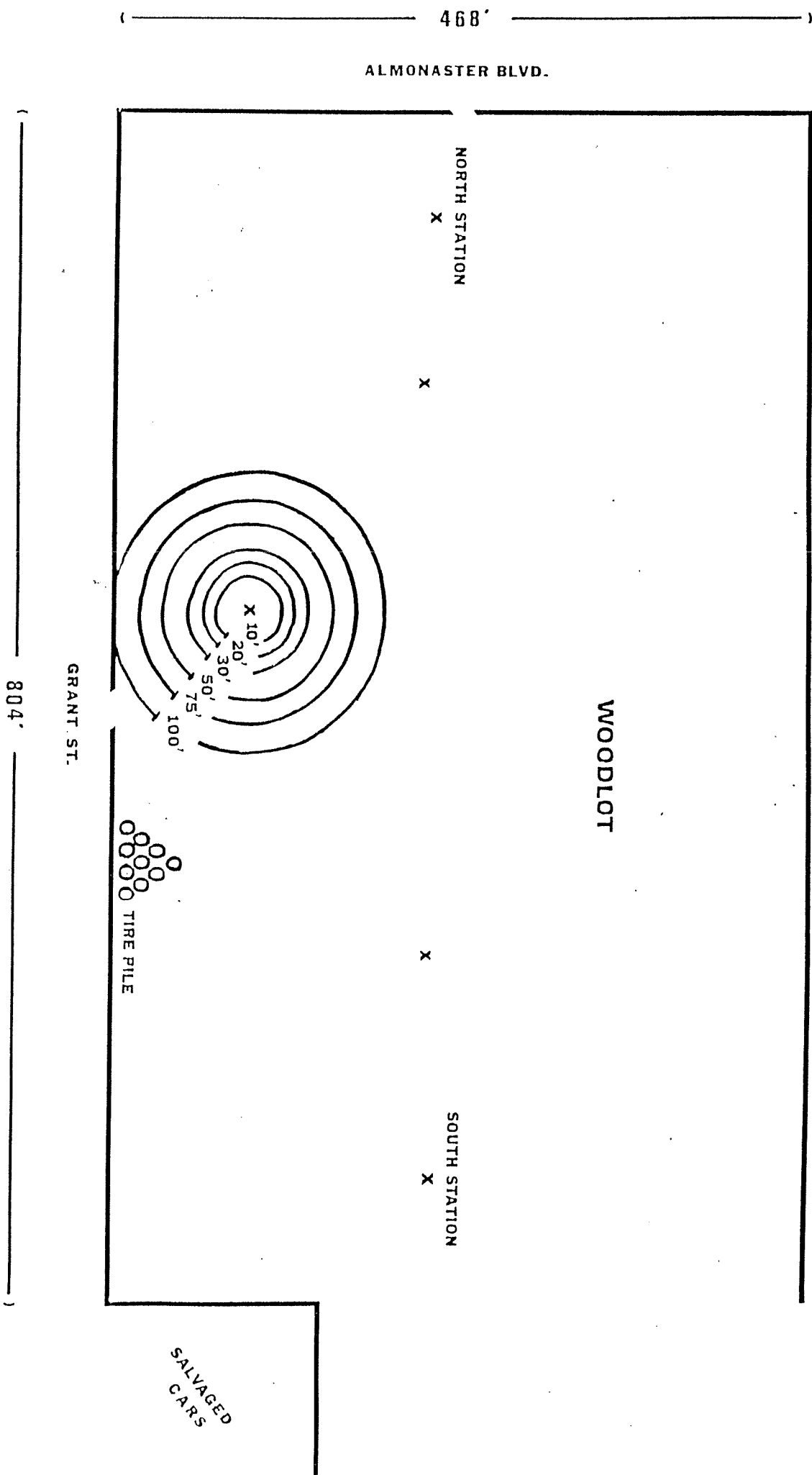


FIGURE 10

Mark-Release-Recapture Experiment No. 1

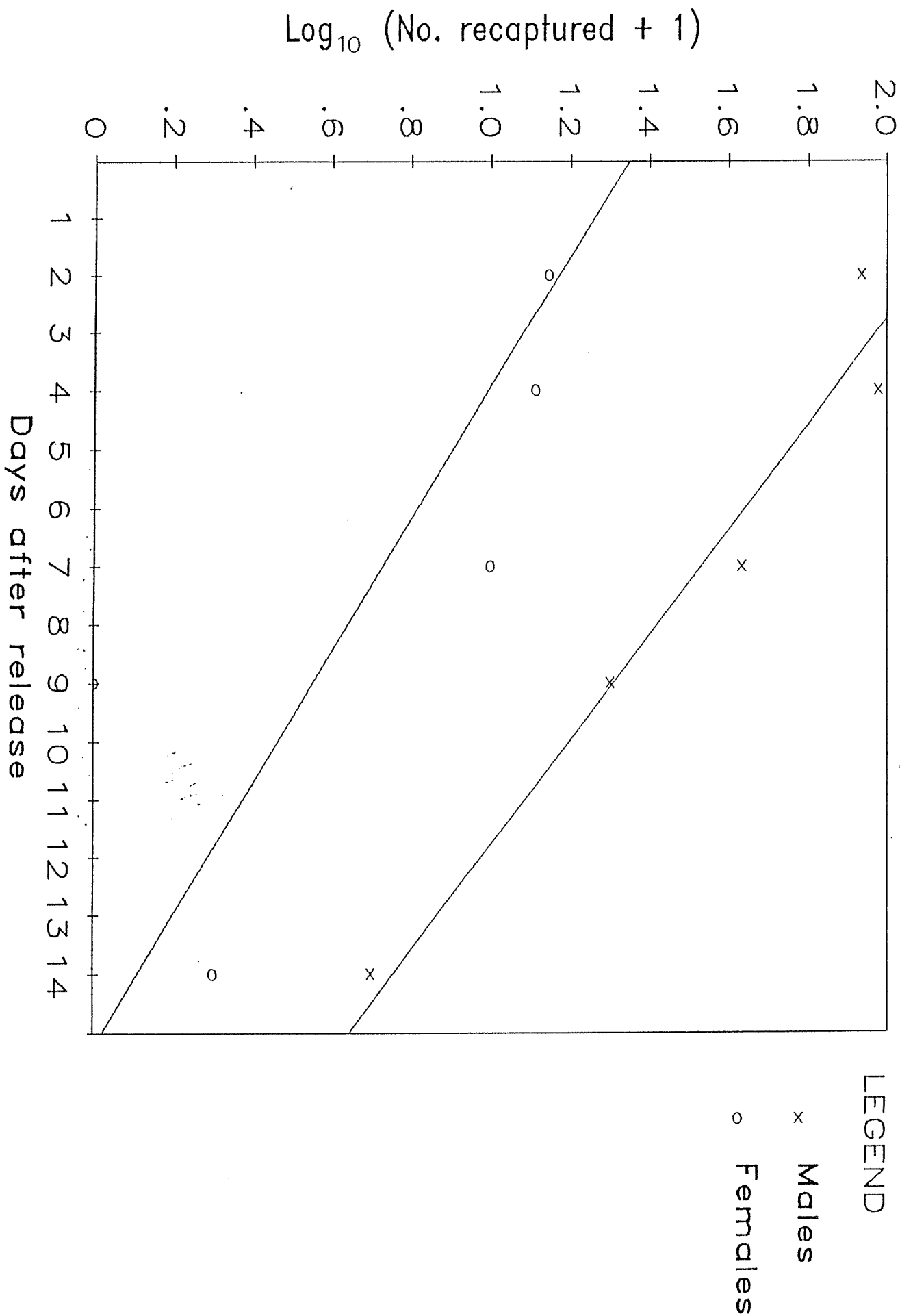


FIGURE 11

Mark-Release-Recapture Experiment No. 2

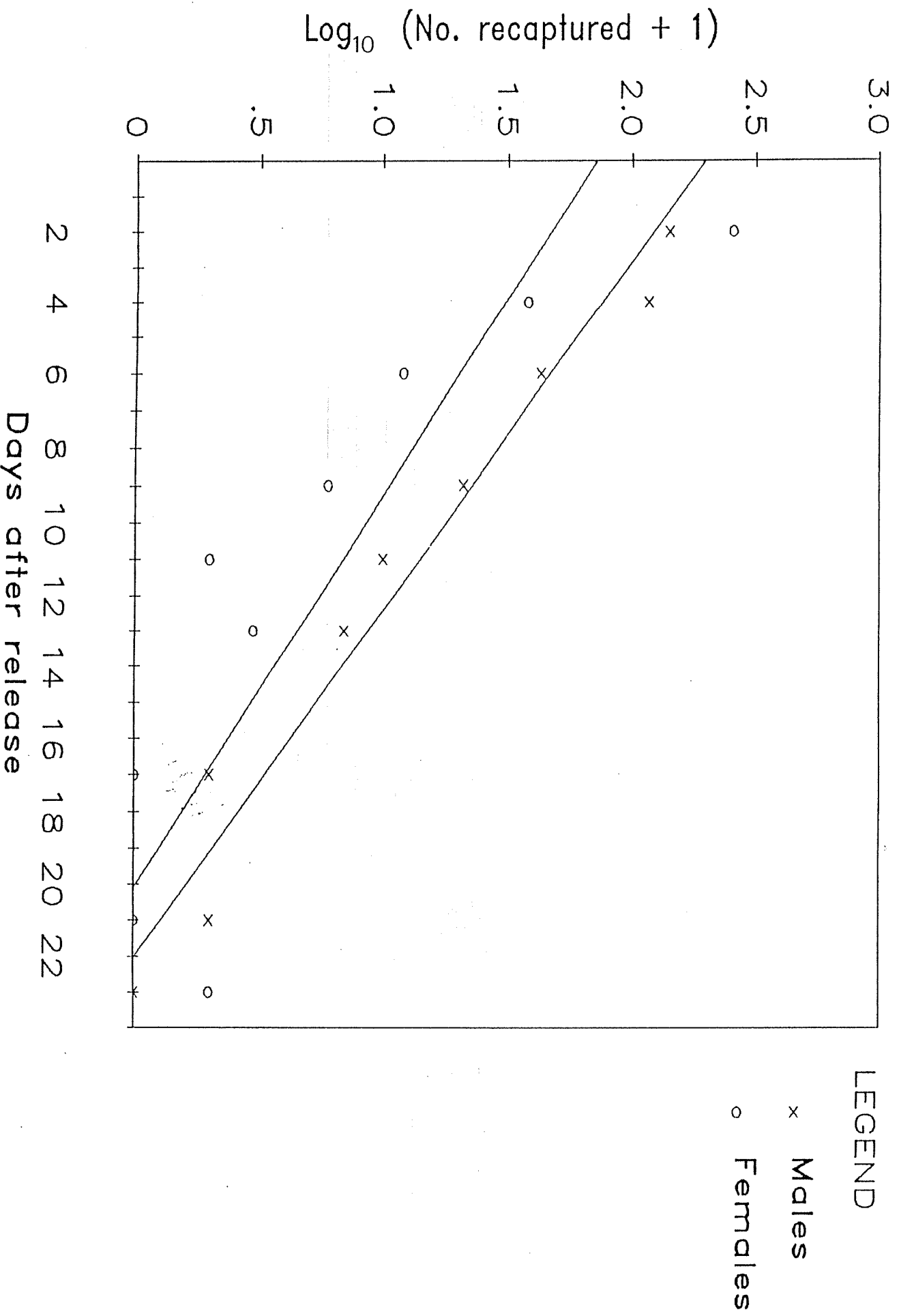


FIGURE 12

Mark-Release-Recapture Experiment No. 3

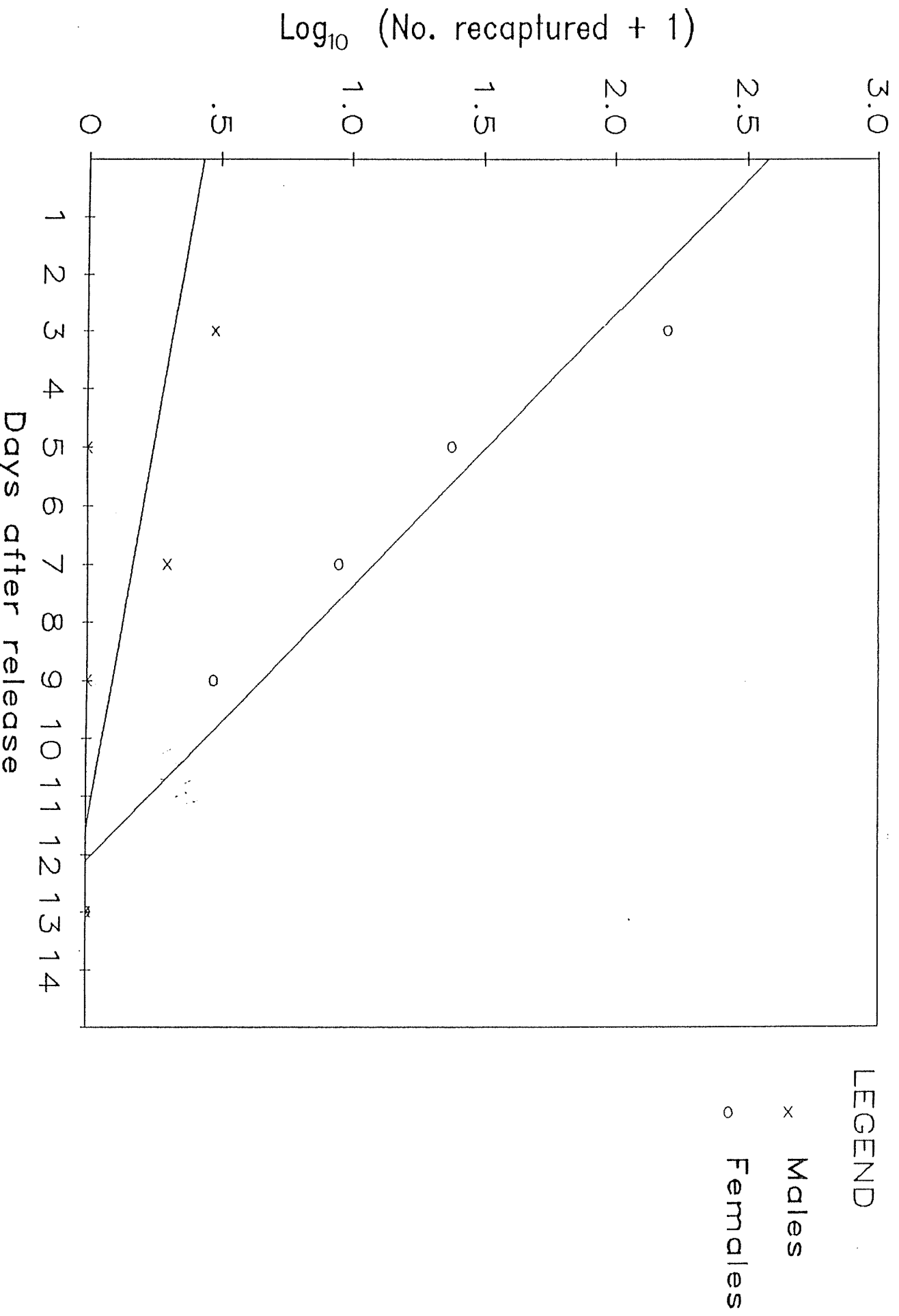


FIGURE 13

Mark-Release-Recapture Experiment No. 4

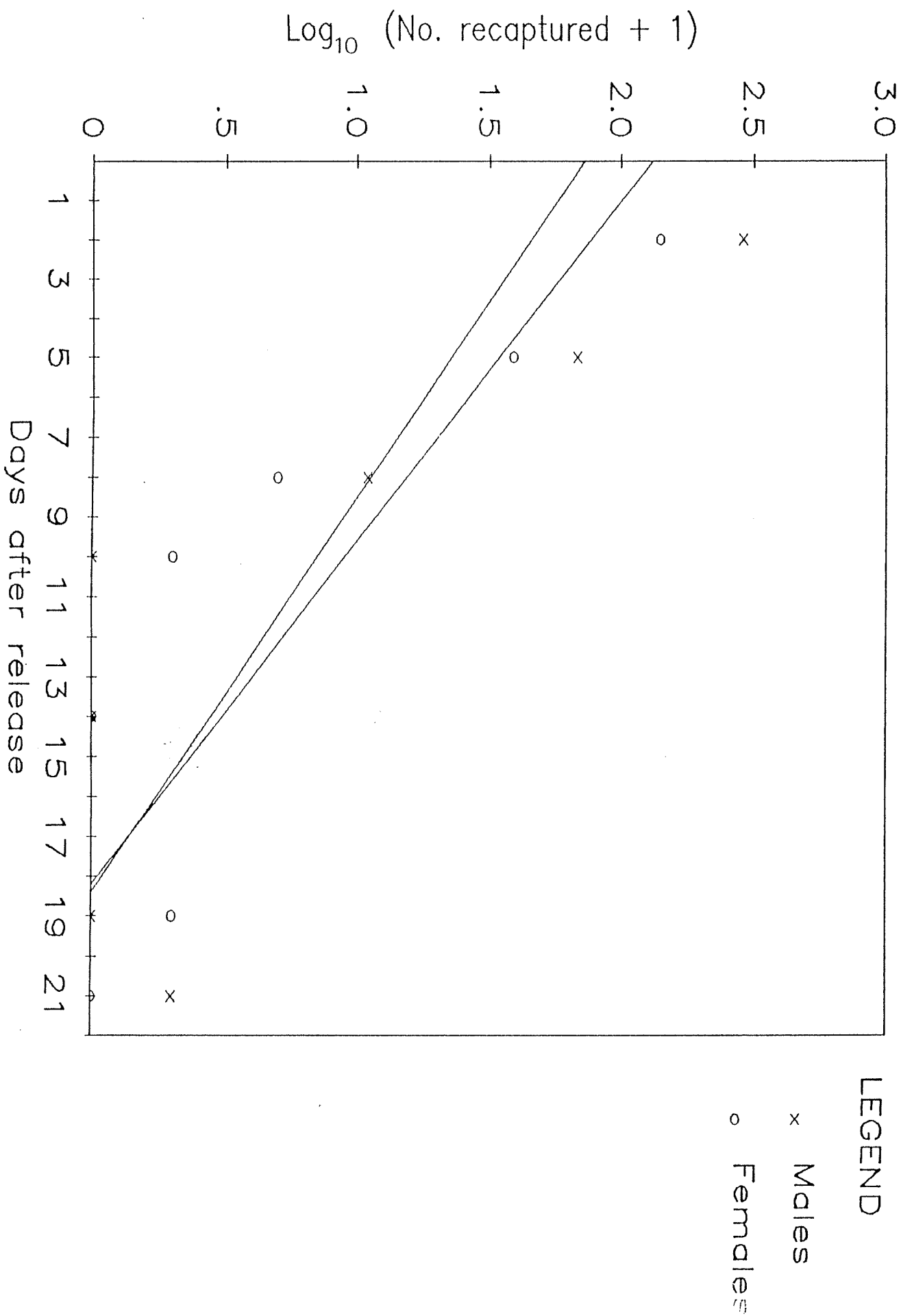


FIGURE 14

Mark-Release-Recapture Experiment No. 5

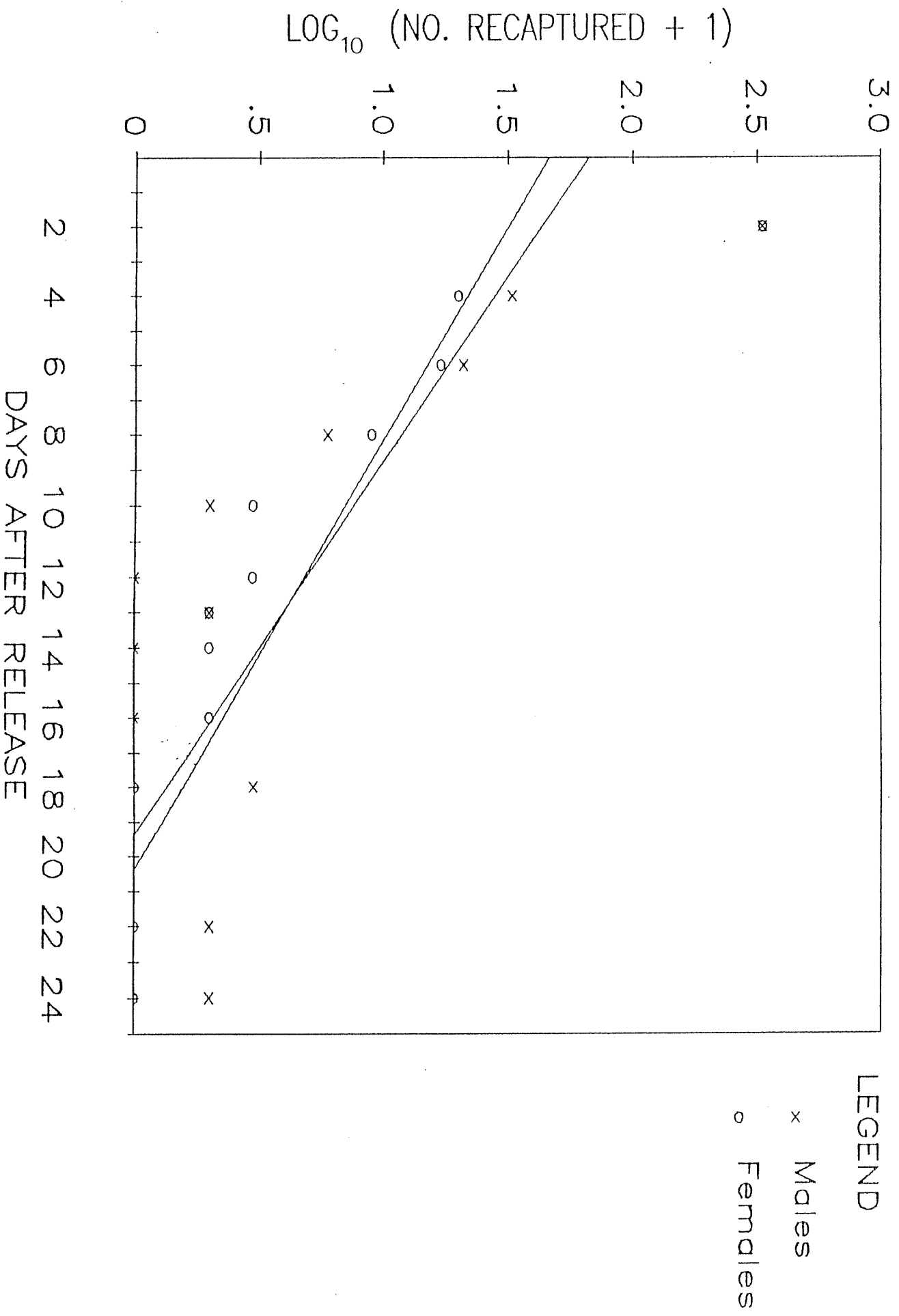


FIGURE 15

Mark-Release-Recapture Experiment No. 6

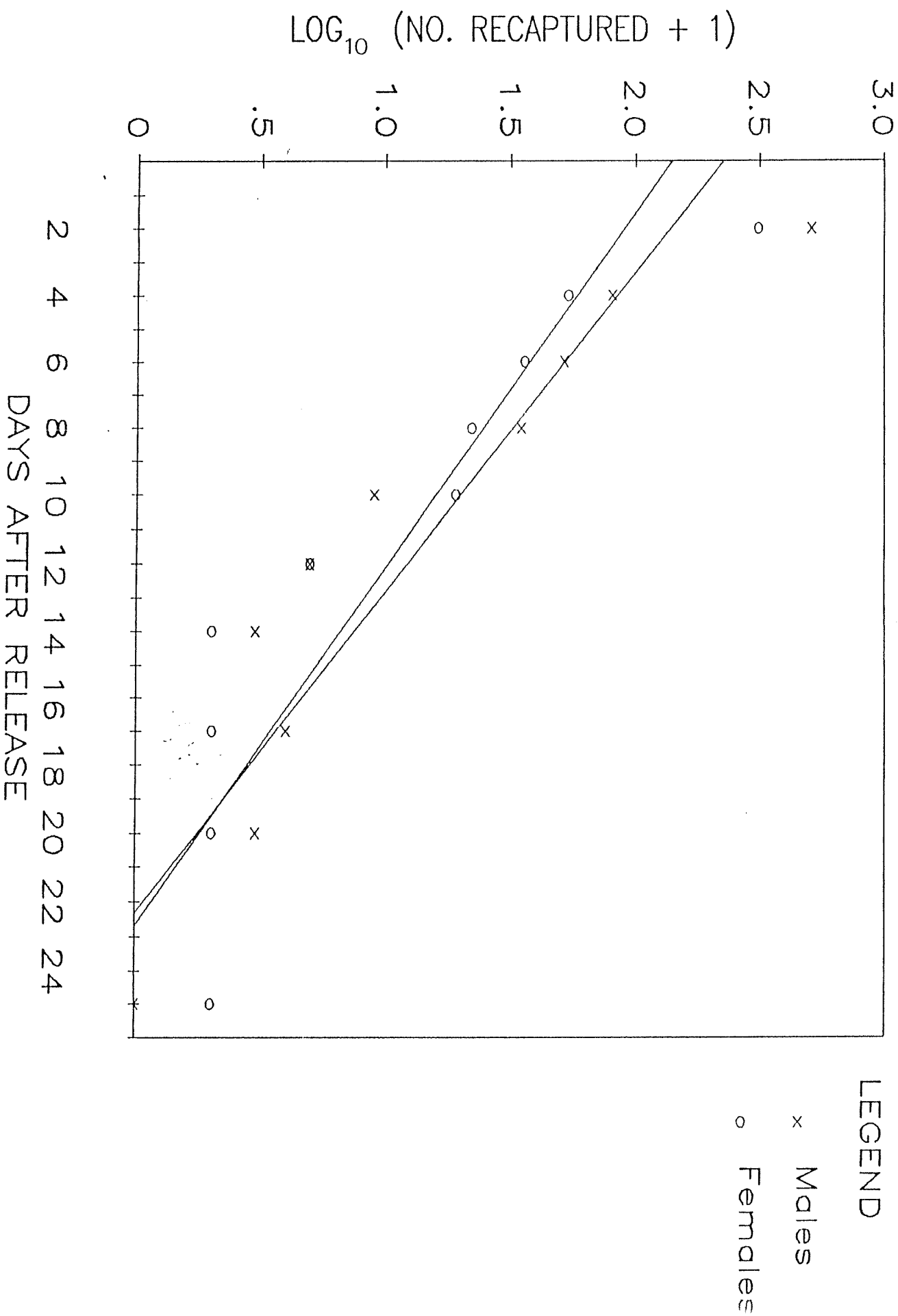


FIGURE 16

Mark-Release-Recapture Experiment No. 7

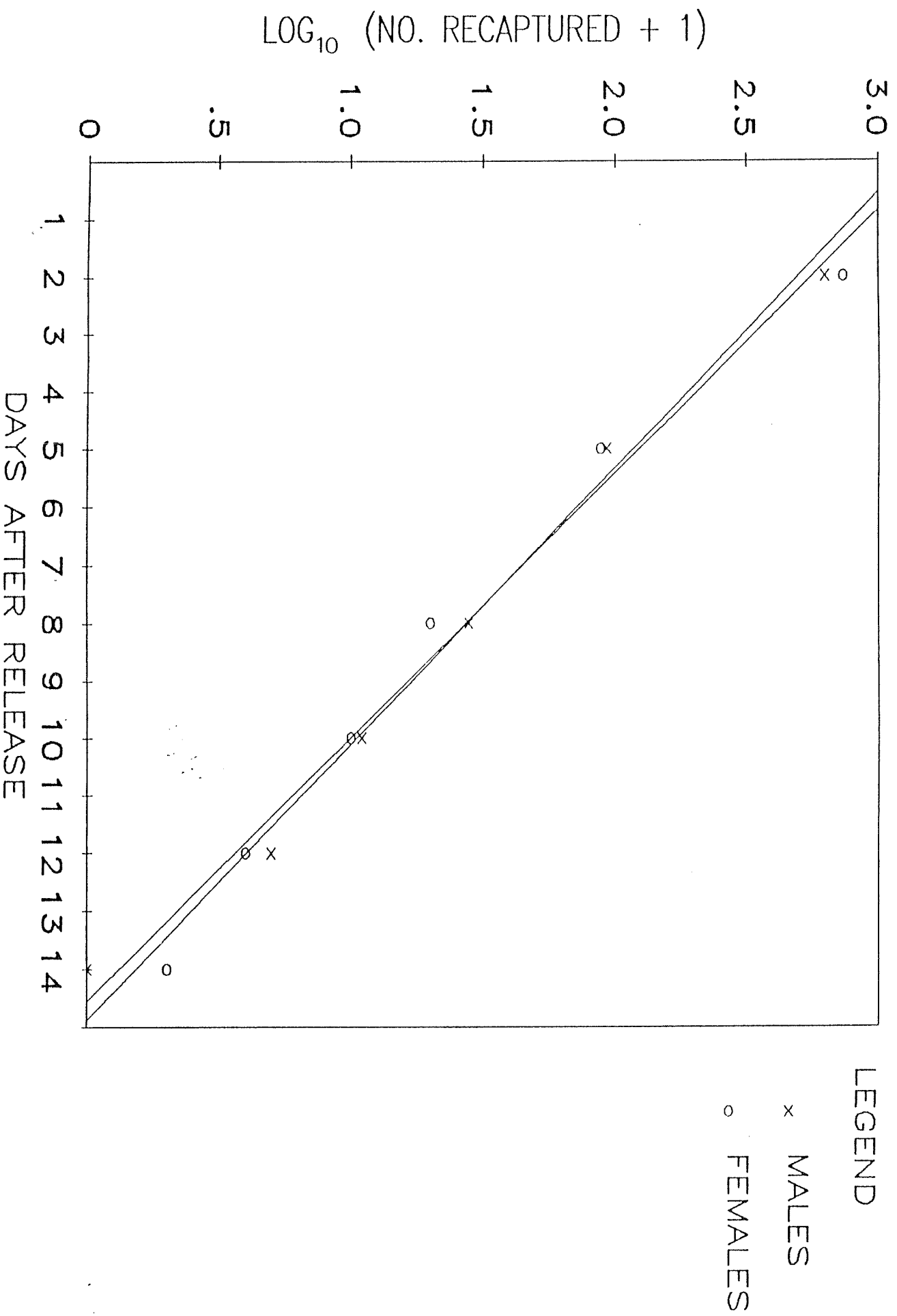


FIGURE 17

Mark-Release-Recapture Experiment No. 8

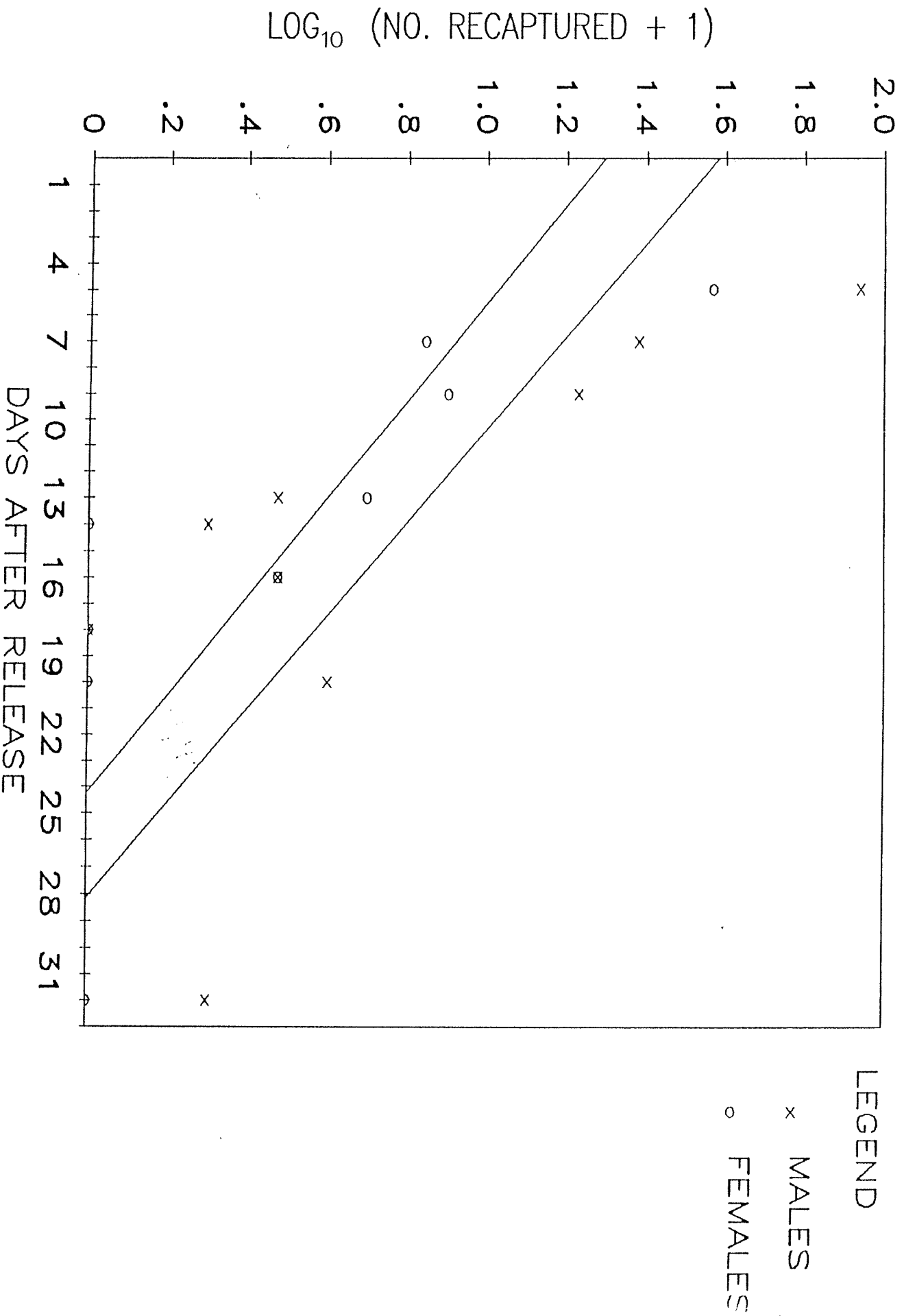


FIGURE 18

Mark-Release-Recapture Experiment No. 9

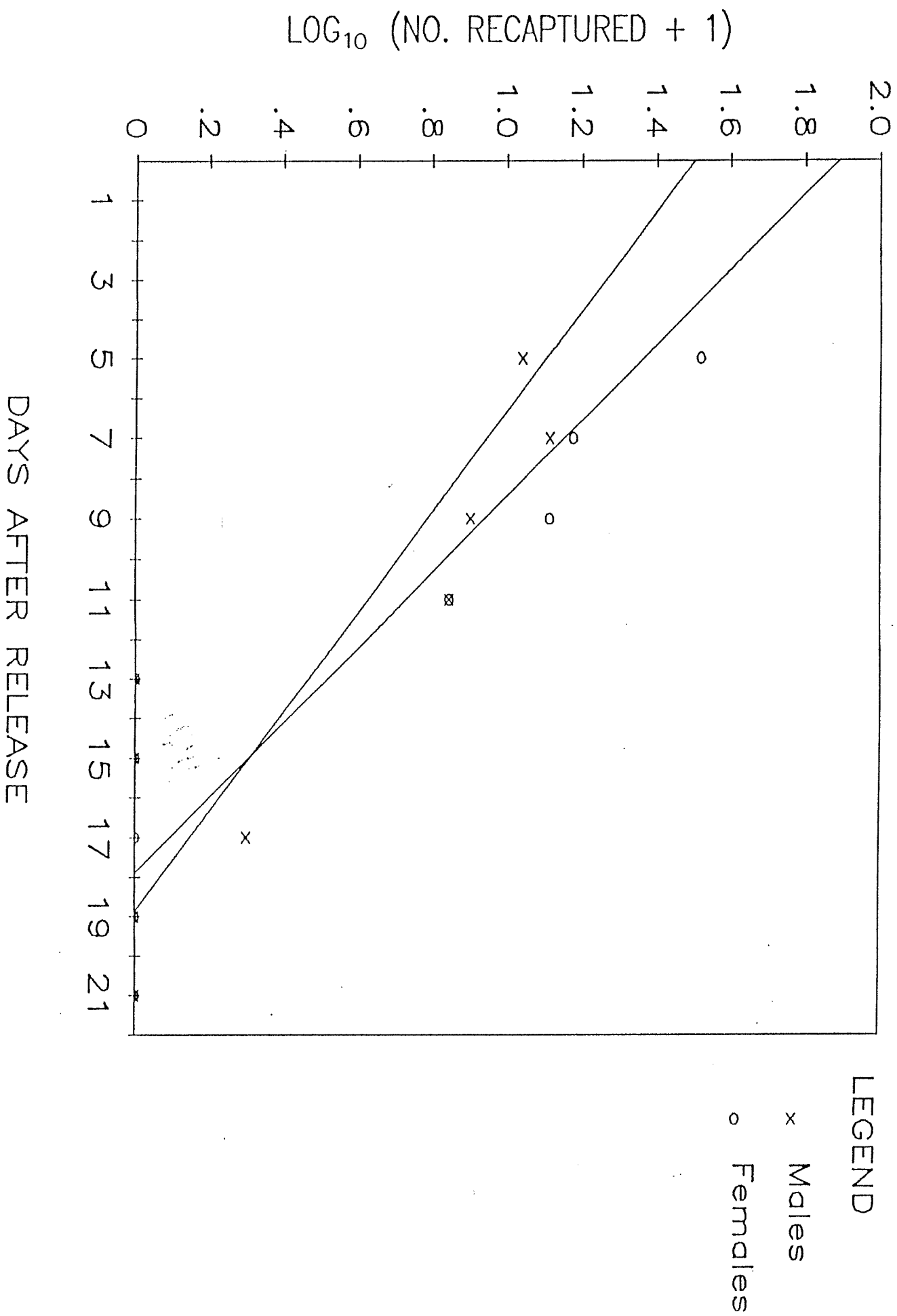
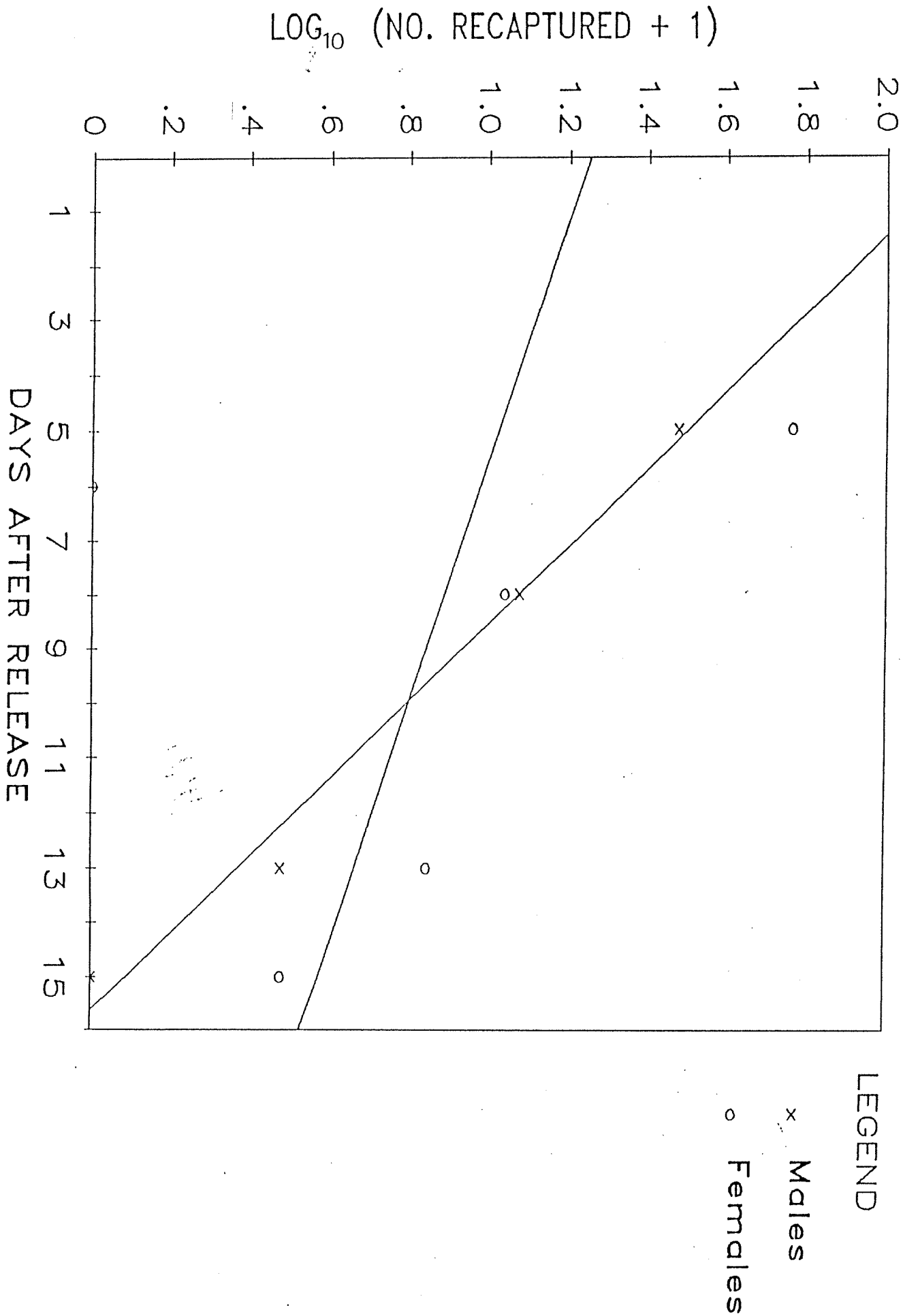


FIGURE 19

Mark-Release-Recapture Experiment No. 10



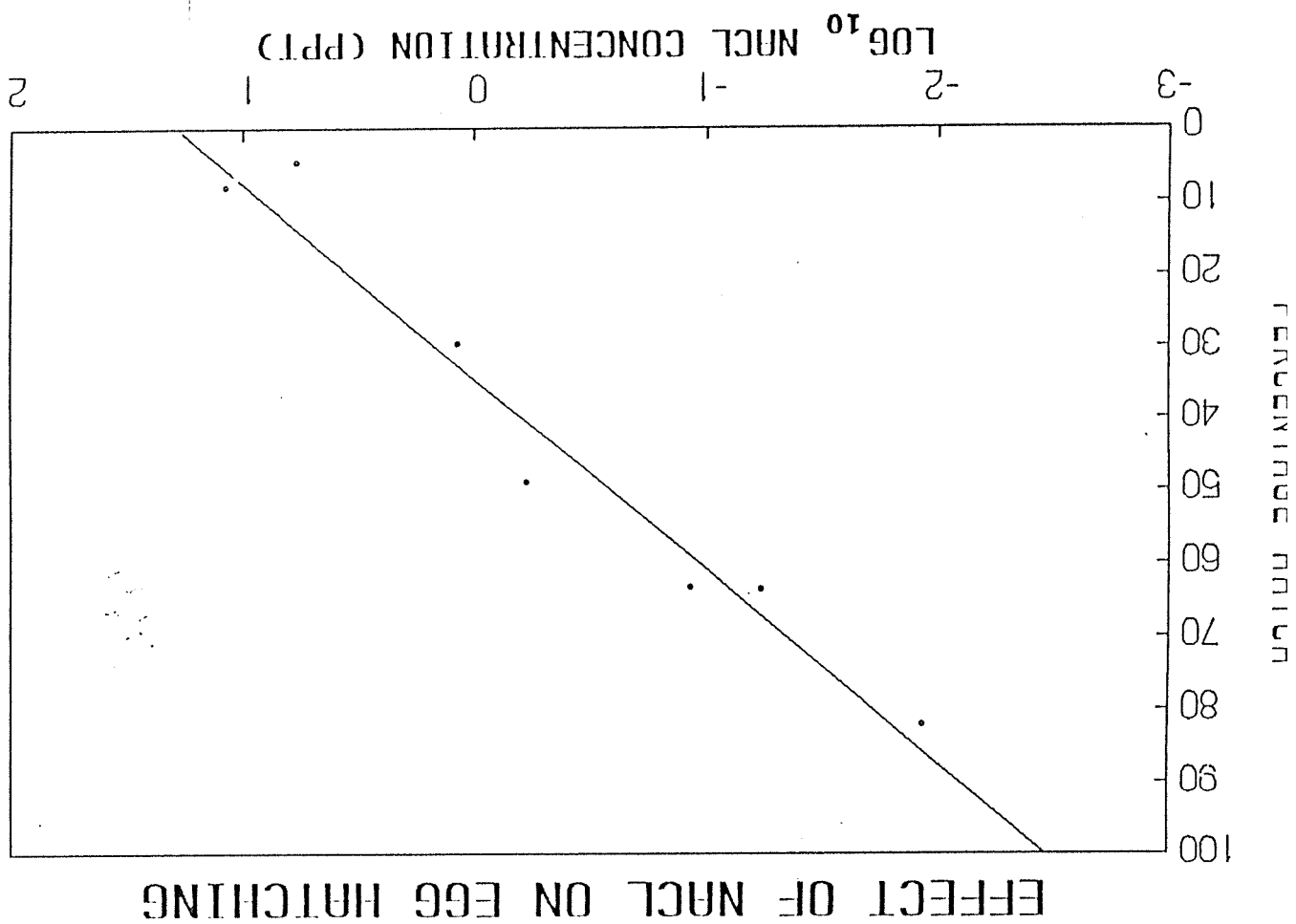


FIGURE 20

ENTOMOLOGICAL REPORT

The way it was: "Inspection based on rainfall data is the essence of good mosquito control. The inspection-mapping phase of the program completed more than 38,000 acres of previously uninspected areas in approximately 2,000 man-hours during 1965. The bulk of the work was accomplished east of the Industrial Canal. Mapping during the early months of 1965 was recorded by freehand sketches; this, of course is time consuming and not entirely accurate. However, in April, aerial photographs were obtained and efficiency increased by 56% during the first month of use."

In 1965, 23 New Jersey light traps collected 78,376 Aedes sollicitans adults. In 1987, 32 New Jersey light traps collected 652 Ae. sollicitans adults.

Largely due to long term source reduction projects and an effective larval surveillance and control program, we have experienced dramatic changes in the numbers and species of mosquitoes we keep under control.

From 1965 to 1987, our adversary has moved from the marsh to the tire casing. In 1965 we were developing better methods of Ae. sollicitans surveillance and control. In 1987 we were scratching our heads attempting to determine what methods might work for surveillance and control of Ae. albopictus. Mosquito control continues to be a dynamic process.

The predominant pest species of mosquito throughout 1987 was Cx. salinarius. Mosquito activity for the first and last quarter of the year was below average with the second and third quarters at or above seasonal average. Flood water breeders were not successful, as we had no tropical storms or prolonged periods of rainfall. Over 95% of the light trap collections in the first quarter was permanent water breeders.

During the summer months, the majority of the inspection time was used to support Aedes albopictus investigation.

Numerous insecticide susceptibility and biological studies were completed, and appear elsewhere in this report.

LARVAL SURVEILLANCE AND CONTROL

Larval activity for 1987 began with an abundance of Culex salinarius in January. Almost daily rainfall filled most urban ditches and swales, 27% of which were positive for larvae.

Continued rainfall (14 consecutive days) in February produced minor flooding, which made field inspection impractical. It was evident that larval activity from January continued, as 99.3% of the light trap collections was permanent water breeders.

March and April were relatively dry, allowing us to shift our inspection efforts to treeholes and ground containers.

May and June produced substantial rainfalls, and produced several pestiferous broods of flood water mosquitoes.

July and August were hot and dry, which triggered Culex quinquefasciatus larval activity.

The remainder of the year's climate was ideal for humans, but tragic for our adversary, as the weatherman's comfort scale bounced between 9 and 10.

Potential breeding sites inspected		Total	No. Wet	No. Dry	Positive	% Wet
1045(1040)1	591(559)	454(481)	94(100)	16(18)		

Total man hours inspecting & treating	Total	Cost
1137 (1371)1	\$6822 (\$ 8226)	
Total man hours supervising, office, miscellaneous	121 (218)	2073 (3455)
Miles traveled	6140 (7261)	923 (1089)
Gal. Altosid SR-10 mix	0 (3)	0 (4)
(4 oz./10 gal. water)	0 (3)	0 (4)
Gal. Diesel/Triton	16 (8)	18 (8)
No. Altosid briquets	11 (65)	4 (16)
Gal. Bti in water @	5 (1)	6 (1)
0.1 pt/tech/ac		
TOTAL COST:1014		\$9846 (\$12799)

1 1986 Data

ADULT MOSQUITO SURVEILLANCE

During 1987, the New Jersey light traps ran on 3,167 trap nights out of a maximum potential 3,360 nights (94%). This is 2% below last year's 96%. The major problems were electrical. Traps #18 (Ponchartraine Park) and #30 (Riglets) are public sites that were without power most of the year.

As last year, the most active trap site was #1, the lower coast of Algiers, which collected 25,096 females (251/trap-night). Of that total 23,406 (93%) were *Culex salinarius*. Only 2% of this species were male, compared with 14% city-wide. The least active trap was #3, mid-Algiers with a total of 662 females (6.3/trap-night).

ADULTICIDING

Ground ULV adulticiding increased over 1986 by 36%, with 156,603 acres sprayed in 1987. Aerial ULV adulticiding increased 5% over 1986, with a total of 110,633 acres treated. The twin-engine aircraft treated a total of 81,048 acres and the single-engine aircraft applied 1,141 gallons of 91% malathion (90 gal. @ 3 oz/ac, 1,051 gal @ 2 oz/ac) and 77.3 gallons of Scourge/mineral oil (1:2.33 v/v) @ 1 oz/ac. The single-engine aircraft sprayed 97.1 gallons of 85% naled @ 1 oz/ac and 101.7 gallons of Scourge (above mix) @ 1 oz/ac.

The truck mounted ULV LECO HD's sprayed a mixture of 1 part Scourge (18% resmethrin, 54% PBOT) to 14 parts mineral oil (v/v) @ 10 mph and 8 fl.oz/min. The amount of ground spraying, in descending order was June (26%), July (25%), May (19%), April (14%), March (4%), September (4%), December (4%), August (3%), October (3%), November (2%), January (0%), and February (0%).

Our spray trucks and LECO's are going on 10 years old and are in very good condition. Ongoing preventative maintenance and cleaning after each mission is undoubtedly the reason for this. Our first fleet of spray trucks and LECO's was retired, as we were unable to procure parts. They were 14 years old. At just over 20 years, the single-engine Grumman Ag-Cat is also in excellent condition, and should give us many more years of service.

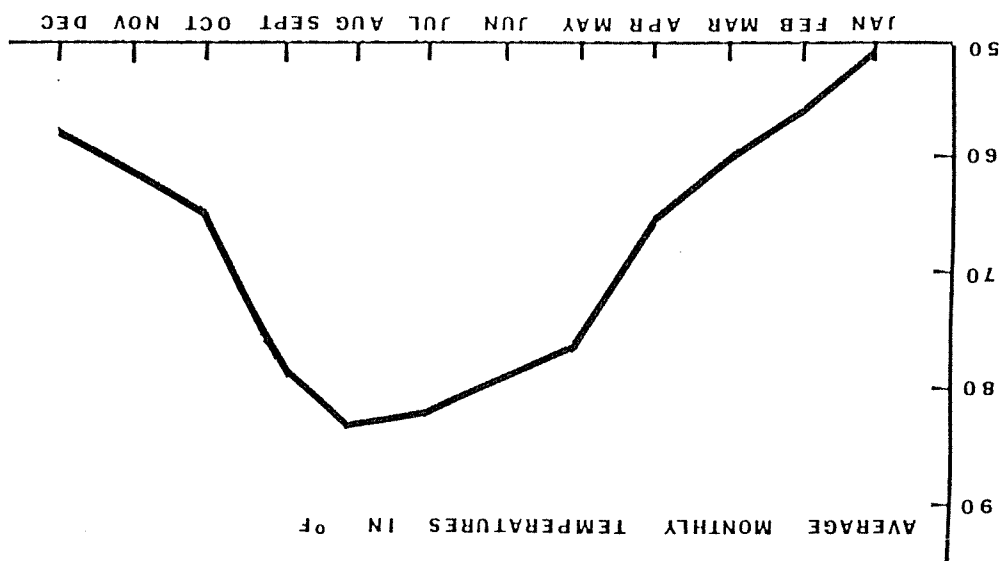
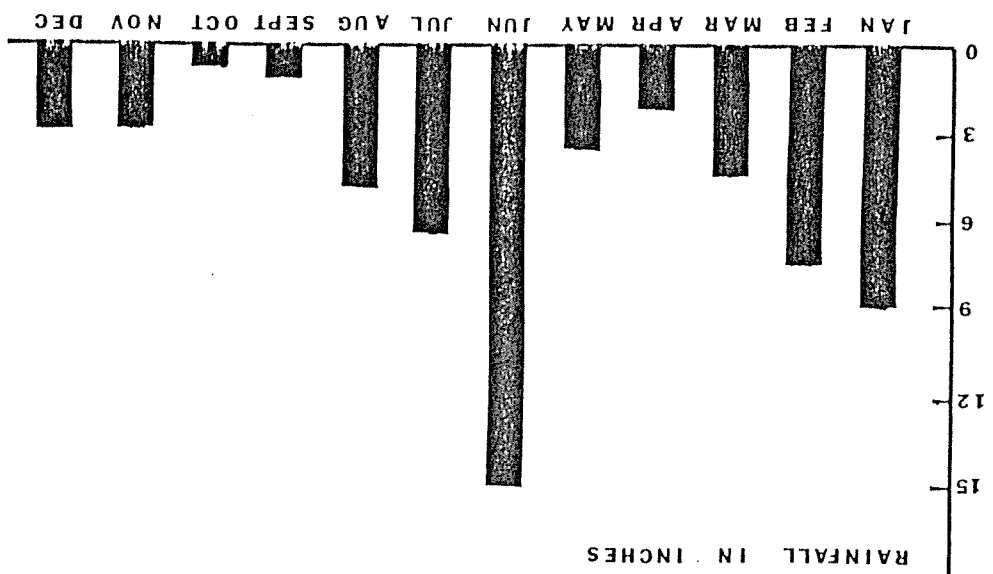
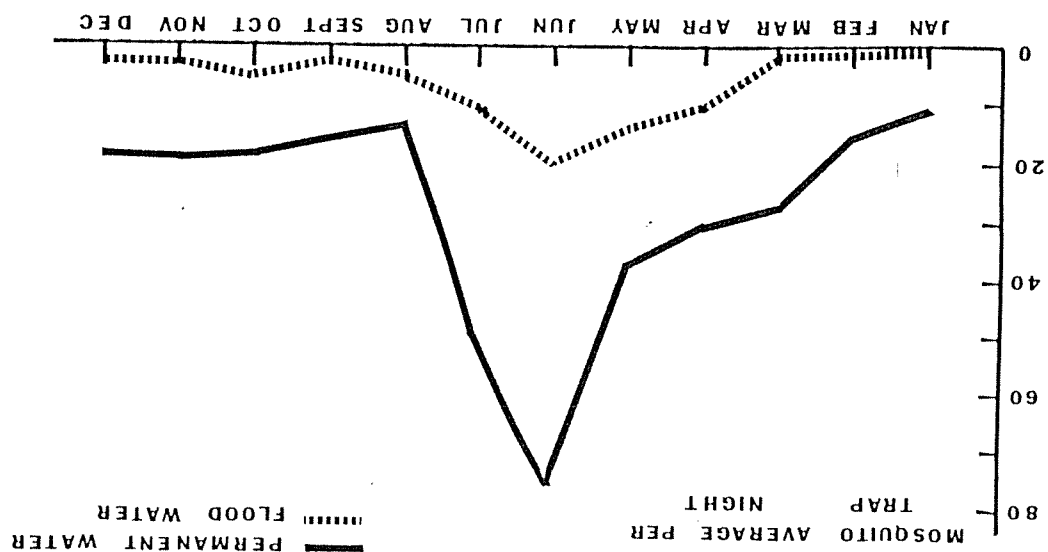
1987 GROUND UEV

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Total man hrs. -0-	-0-	-0-	26	109	155	202	160	21	35	26	14	25	772
\$-0-	\$-0-	\$-0-	234	654	930	1212	960	126	210	234	126	225	6948
Hrs. spraying -0-	-0-	-0-	15.1	60.9	80.5	111.6	93.6	11.8	15.4	14.6	10.6	16.6	430.7
Gal.mix/\$ *	-0-	-0-	33.5	196.7	316.6	380.8	335.5	45.9	58.7	58.1	38.3	58.8	1522.9
\$-0-	\$-0-	\$-0-	380	2233	3593	4322	3808	521	662	659	435	667	\$17285
Total miles traveled/\$	-0-	-0-	280	1151	1919	2370	1900	2249	425	321	178	376	9168
\$-0-	\$-0-	\$-0-	42	173	288	356	285	37	64	48	27	56	1376
Total cost spraying	\$-0-	\$-0-	656	3060	4811	5890	5053	684	936	941	588	948	23567
Total acres sprayed	-0-	-0-	5490	22143	29270	40578	34033	4291	5599	5309	3854	6036	156603
Spray cost per acre	\$-0-	\$-0-	.12	.14	.16	.15	.15	.16	.17	.18	.15	.16	.15

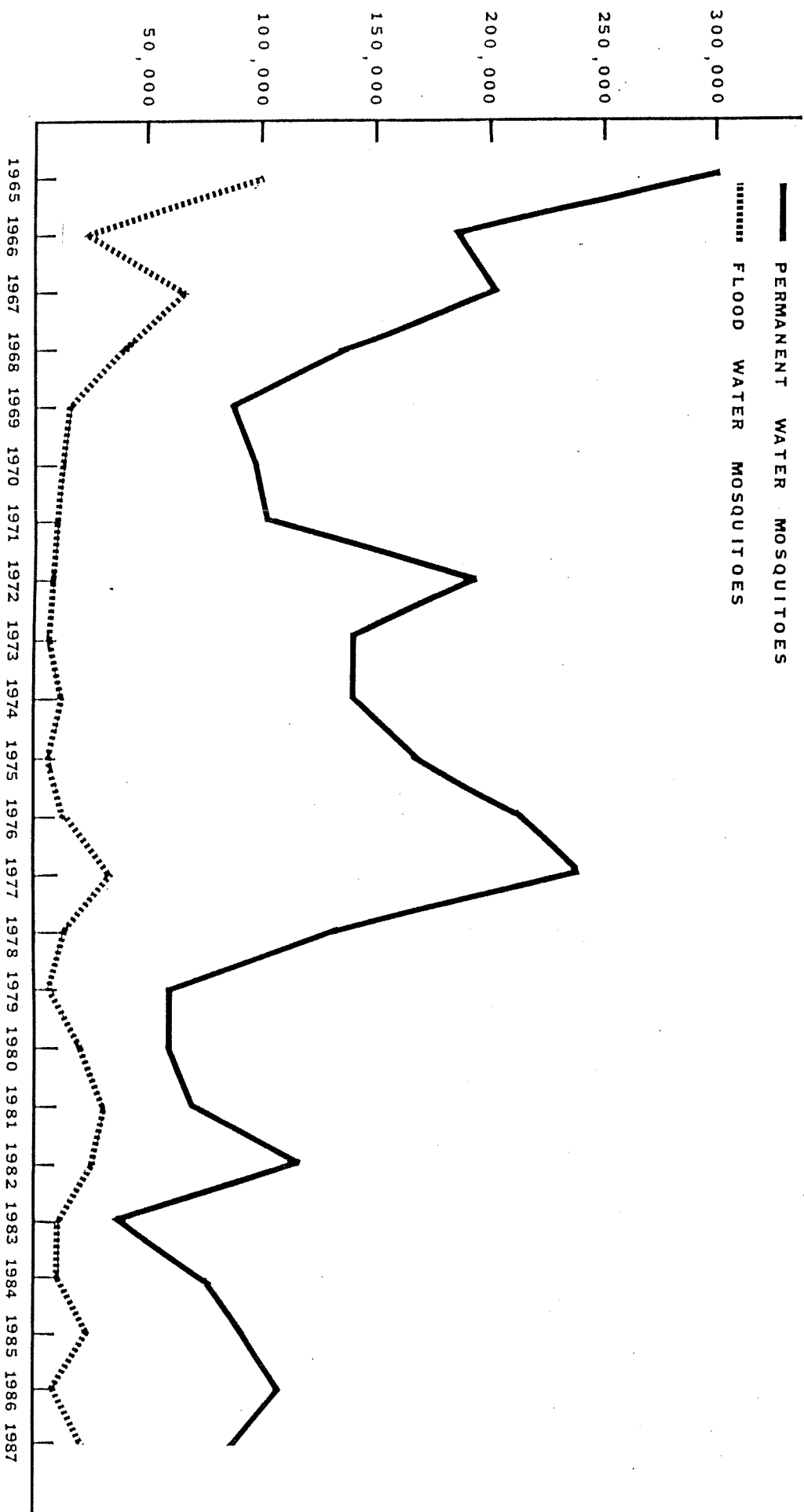
* By volume: 1 part Scourge to 14 parts mineral oil @ 10 mph and 8 fl oz/min

4% 14% 19% 26% 22% 3% 4% 3% 2% 4%

MOSQUITO / ENVIRONMENTAL CORRELATION



FEMALE MOSQUITOES COLLECTED



(Bi-weekly Operation of New Jersey Light Traps)

MOSQUITO VECTOR MANAGEMENT

The mosquito vector management program was under a different entomologist in the spring, summer, and fall of 1987, respectively. Mike Andis left the NOMCB in March and is now working for Roussett-Bio UCLA Corporation in New York as director of research and development. His major efforts involved the implementation of monitoring and surveillance techniques for the new imported species, Aedes albopictus, the Asian Tiger mosquito, and monitoring susceptibility tests. After Mike Andis left, Daniel Roussett remained as the laboratory technician and stayed only for a short time, leaving the NOMCB in July. Daniel was involved in installing and using computer programs to speed up the data analysis process. He wrote a program to calculate VMD and LVD for droplet size analysis.

After Daniel left, the entomologist position was vacant from July through September, and consequently no research reports were written under the vector mosquito control section. I started working in October and was lucky to have arrived at a time when the mosquito populations were slowing down, so I was able to ride along with the inspectors and the researchers to get a good handle for the daily activities and research at NOMCB. I have found the NOMCB to be a wonderful place to work and was pleasantly surprised that the project is open minded and involved in applied research in addition to having an efficient surveillance and control program. Everyone in the staff is willing to help and offer suggestions, and they have made me feel like part of a big family.

Most of the research for mosquito vector control was conducted by the previous entomologist and I am still fairly unfamiliar with the field studies, but for this report I will try to summarize the results of that research.

Daylength is the driving natural force that induces egg diapause for Ae. albopictus, and temperature forces Ae. aegypti to overwinter. Both species appear to overwinter as eggs in New Orleans. Although many showers fall in January and February that flood containers such as tires and buckets containing mosquito eggs, hatching may not occur when the daylength is short, even if the weather is warm. It is possible, however, that some low level production of larvae of other species may result if the temperatures reach a certain level. Winter monitoring for adult activity using ovitraps and UV-Ray traps was negative in January and February; therefore, ovitraps surveillance in the winter months will be discontinued based on the results of 1986-1987 winter collections in east New Orleans. Larval surveillance is the most reliable means of determining development of mosquito species that overwinter as eggs, and based on these results, ovitraps need not be implemented in the field until mid-March when the daylength reaches the

threshold level required for the eggs to break out of diapause. A method used to establish when the eggs break out of diapause is to bring tires and other containers from the field into the lab and to periodically flood them. More data is still needed in order to develop predictive models for development of Ae. albopictus and other mosquito species that overwinter as diapausing eggs.

Discarded tires continue to be the most efficient container for supporting larval populations of Ae. aegypti and Ae. albopictus in the summer and fall. In winter, Cx. salinarius and Cx. inornata are the most predominant species, but colonization of either species is still on an experimental basis. Treeholes in mature stands of hackberry trees were found to be a more attractive oviposition site to Ae. triseriatus than to any other species. Ae. albopictus will also utilize treeholes for breeding but to a lesser extent. Data gathered from the treeholes supports the hypotheses that Ae. triseriatus overwinters in the larval stage.

As mentioned before, Daniel Rousset wrote a computer program in BASIC to calculate the VMD and LMD for droplet sizes and it has been extremely useful since we can now determine droplet size in a fraction of the time that it used to take calculating them by hand. The important aspect of droplet analysis, though, is that we can determine if the application equipment is working properly. Not only are large diameter droplets (greater than 70 microns) incriminated in the staining of car finishes, but it also results in expensive and inadequate adult mosquito control because the droplets settle too fast and miss their target. Ground ULV and aerial ULV equipment is checked periodically as part of the NOMCB routine operations to avoid any such consequences.

Computers have become increasingly more important at NOMCB not only to speed up calculations, but to analyze, store, and retrieve data. Data base files and spreadsheets have been created for susceptibility tests, oviposition data and many other facets of mosquito vector research using dBase III Plus and Lotus 1-2-3. Although the programs take a lot of time and effort to learn, once the program has been mastered it becomes almost second nature to enter the data into the computer and get an immediate analysis of the data. As the projects in mosquito vector management become more complex and expansive, field and laboratory data must be handled with computers or it becomes too frustrating and complicated to analyze. Eventually, a database customized specifically for the NOMCB operations will have to be implemented and integrated to make recording, analyzing and reporting a much easier and efficient task.

The scope of the NOMCB has become increasingly more international, especially now that our cooperative efforts with Dr. Jerry Freier of the CDC have created a unique situation for the study of biotic and control parameters of Ae. albopictus. Visitors from Brazil, Switzerland, and Honduras toured our facilities to get a first hand look at our surveillance

In the beginning of 1987, our staff was busy preparing emergency strategies for dealing with the continued spread and possible insecticide resistance of Aedes albopictus, the mystery mosquito that showed up in Orleans Parish as well as in other parts of the country the previous year. Although we quietly expressed some hope that the Asian Tiger guest simply would not reappear after winter, this feeling was quickly buried when in early springtime this species showed up again in its beloved junkyard, artificial containers, and in tire disposal sites and substandard housing neighborhoods, as if it had been there for ages. There is no indication that Ae. albopictus gave up any of its acquired territory - on the contrary, there were reports about its expansion to other corners of the country, as far as Delaware, for example. However, there has not been too much progress in the appearance of the species in Orleans Parish, as some of the areas are still free from Ae. albopictus. Many things about this species remain unexplained. Last year's studies uncovered some limitations in that it seemed an uncontrollable yet extremely adaptable species. We understand some of its biology, but are still not totally aware of its broad transmission potential for arboviruses. At this point we do not know how the whole affair will end up, whether Aedes albopictus will stay with us for good, as Aedes aegypti did when introduced to this land, some three hundred years ago, or whether it will diminish in the manner it showed up, or if there will be an eradication plan to get rid of this unwelcome guest. Yet,

LABORATORY REPORT

1	Includes surveillance, operational evaluations, and insecticide susceptibility studies.
2	Previous year's parameters.
Surveillance ¹	1283 (2916)
Miles traveled	1949 (6634)
TOTAL COST:	\$9084 (\$20,239)
Hours	292 (995)
Cost	\$9196 (\$21,234)

and control operations, and to gain some insight on susceptibility testing and field and laboratory studies of Ae. albopictus. As part of our international program, training videos produced by the NOMCB video specialist have been dubbed with a Spanish translation and are now in use in Brazil, Honduras, and Puerto Rico. The delegates from the city of Puerto Cortes, Honduras, that visited our facility were very much interested in NOMCB and have invited us to visit their city to study their mosquito problem. It is hoped that from these visits, exchanges of ideas will result in a much broader understanding of the mosquito vectors affecting man.

Aedes albopictus was again "Mosquito of the Year", the most studied and considered species, but with less an emphasis and aura of sensation than in the previous year.

INSECTICIDE SUSCEPTIBILITY

Results of routine susceptibility tests on field collected and colonized populations of Orleans Parish major vector mosquito species in 1987 varied insignificantly from data obtained the previous year; thus no cases of insecticide resistance were detected. Ancillary projects in susceptibility studies resulted in a wide range of problems. First of all, NOMCB standard larval susceptibility testing procedure was established. Our methodology originates from the World Health Organization standard. There are certain differences, but we are confident that our procedure suits the best mosquito control adaptation. Using technical grade pesticides is especially justifiable in this aspect. Dr. Shidrawi, working at the WHO headquarters in Geneva and responsible for vector resistance monitoring, was pleased with our susceptibility testing procedure, as he came to our facility solely to discuss the matter of larval tests.

Another phase of this report describes in detail pupae susceptibility testing. This overlooked problem was studied in our laboratory, and for mosquito control purposes, the conclusion was that at this time we have very limited tools to conduct studies on pupal populations detected in the field.

In the beginning of the winter season we were able to collect, hatch, and rear enough Culex salinarius egg rafts to conduct larval susceptibility tests against four major adulticides (see Table 1). Culex salinarius larvae, in confrontation with dilutions of malathion, proved to be susceptible and are, in fact, more susceptible to this chemical than any other species that was subject to testing. The same situation was observed in the instance of Scourge and naled. During exposure to permethrin, Cx. salinarius gave results similar to the other species.

To process insecticide testing data, we used applicable computer programs. Those include Probit Analysis calculating and data gathering programs, such as dbase III Plus and EpiStat.

Several mosquito control workers from different corners of the world visited our laboratory last year, and were introduced to our insecticide testing procedures.

one of our studies in 1987. So called greater resistance of pupae to chemicals, as compared to larvae, in practice really does exist, but the laboratory uncovered new aspects of the issue. When we talk about control of pupae, there is only one group of pesticides that ensure success of action. Only the application of oil or any other substance that has a radically lower surface tension will immediately affect pupae. Other

larvicides might reach the mosquito through the pupal skin sooner or later, or too late. Air space inside the body causes the pupae to ride too high in the water, the trumpets overturn and submerge with suffocation following (Monzeil, 1941). Table 2 shows toxicity of permethrin to pupae of six different mosquito species. The table shows results on the basis of 24 hour exposure. However, in mosquito control practice, older pupae can survive multiple lethal concentrations, and mosquitoes emerge after being exposed only a few hours to the chemical. Also, data for *Aedes aegypti* and *Aedes albopictus* are combined from separate tests with sexed insects. Comparison of males and females led to additional research that showed, without any doubt, male pupae required almost twice the concentration of permethrin to attain the LC_{50} than for female pupae. This surprising reaction gives males an advantage in certain intervals of insecticide treatment, in addition to the natural one which is shorter pupal stage duration. The bottom line of Table 2 gives values of the last concentration which let mosquitoes emerge already exposed to permethrin for 24 hours. Those figures do not tell the whole story, either because it could not be determined whether they were healthy adults, or they were unable to leave the surface in the dilution concentrations. More recent publications indicate that during most of the conventional "pupal stage", an adult is enclosed by the remains of the pupal cuticle (there are only a few hours of real pupal period: pupal - adult apolysis occurs shortly after larval pupal ecdysis). For test purposes we call a pupa a mosquito which is not a larva and is living in the water.

Susceptibility of pupae to commonly used larvicides was a subject of Vectobac, a commercial formulation of *Bacillus thuringiensis* H-14, will not destroy pupae. Since pupae do not feed, spores and crystals cannot enter the mosquito body through the pupal skin. At about 1 million times the lethal dosage for larvae, significant mortality in pupae occurs. This produces a thick, milky solution (which for all practical purposes is not an effective pupicide).

Tested concentrations of fenoxycarb will cause pupal mortality, but only when treated during the larval stage.

Table 1. Toxicity of Selected Adulticides to Culex Salinarius Larvae Developed in an Insectary Environment from Field Collected Egg Rafts

Insecticide	LC ₅₀ (95% C.L.)	LC ₉₀ (95% C.L.)	Slope
Malathion	(µg a.i./ml) .0197 (.0188 - .0206)	(µg a.i./ml) .0274 (.0256 - .0304)	8.9
Permethrin*	.00054 (.00049 - .00062)	.00089 (.00082 - .0001)	6.3
Scourge**	.00052 (.00043 - .0006)	.001 (.00082 - .00147)	4.4
Naled	.0124 (.0079 - .0156)	.0204 (.0163 - .0343)	5.9

* Ambush 2E formulation based on amount of resmethrin only

Table 2. Toxicity of Permethrin to Mosquito Pupae (Lethal Concentrations and 95% Fiducial Limits)

<u>Aedes albopictus</u> (New Orleans)	<u>Aedes aegypti</u> (New Orleans)	<u>Tox. amboniensis</u> (Puerto Rico)	<u>Aedes albopictus</u> (Oahu)	<u>Aedes vexans</u> (NO Field col)
LC ₅₀ (µg/ml) (.00878 - .01147)	.00462 (.00395 - .00525)	.01924 (.01865 - .0198)	.01104 (.01046 - .01161)	.00197 (.00140 - .00246)
LC ₉₀ (µg/ml) (.01527 - .02793)	.00799 (.00680 - .010675)	.02154 (.02067 - .0232)	.01386 (.0129 - .01532)	.00450 (.00352 - .00709)
LC ₉₀ for Larvae	.00147	.00282	.00101	.00142
Ratio LC ₉₀ of pupae to Larvae	12.8	12.3	10.9	3.1
Last emerg.	.00567	.00340	.00567	.00284

Last year was marked by increased activity in our insectary. Starting of new colonies, attempts to colonize several species, laboratory and field tests on our own as well as those of the CDC Project - all these undertakings demanded live specimens and special conditions. To name a few of the serial tests, there were 10 Mark-Release-Capture studies during the season, each using about six thousand mosquitoes. These required males separated from females. There were also pupae susceptibility studies. The scale of operation was much larger than in previous years. Several new techniques were employed, and the insectary has been constantly changing toward greater likeness to a natural environment. The pupal separator became a major tool for running the insectary. This handy instrument prevented us from sacrificing a large part of the larval populations that pupate long after the first ones do. Several formulations of desiccated liver powder were tested, and the conclusion was that the product by American Roland Corporation best suits our larval rearing needs. Feeding adults with only a dilution of sucrose probably has significant disadvantages when one is dealing with field collected populations or offspring of it. These are a few basic observations, simple as they sound,

REARING

c.) By the late third instar, predator Tox. larvae become a notorious "killing force" that will eat anything available, including emerged adults, resting on the surface of the water.

b.) Tox. larvae have to reach third instar to destroy Ae. albopictus pupae and will feed without difficulty. However, when given a choice, they show obvious preference toward larvae, leaving pupae sufficient time to emerge.

a.) Late second instar Tox. larvae destroy fourth instar Ae. albopictus and Aedes aegypti larvae. The Tox. larvae made unsuccessful attempts to capture pupae.

Tests conducted with Toxorhynchites amboinensis (Puerto Rico strain) larvae on their ability to destroy prey pupae indicate the following results:

Pupae of Ae. albopictus survive a wider range of water pH levels, pH 1 - 12, compared with pH levels 2.5 - 11 for larvae.

Lethal concentrations of sodium chloride is about 0.5x higher for pupae than larvae. Pupae will die if exposed for a period not shorter than 12 hours in 75 g/l (75 ppt), probably from an osmotic imbalance. In that concentration, pupae cannot maintain a vertical position, therefore, the air trumpets become submerged.

it takes a lot of trying and frustration to reach them. Running an insectary is full of disappointments, and knowledge of it comes from very small observations and very small improvements. In that case, practice proves that all factors are important and an increased rate of mortality among insects always has its reason.

VECTOR SURVEILLANCE

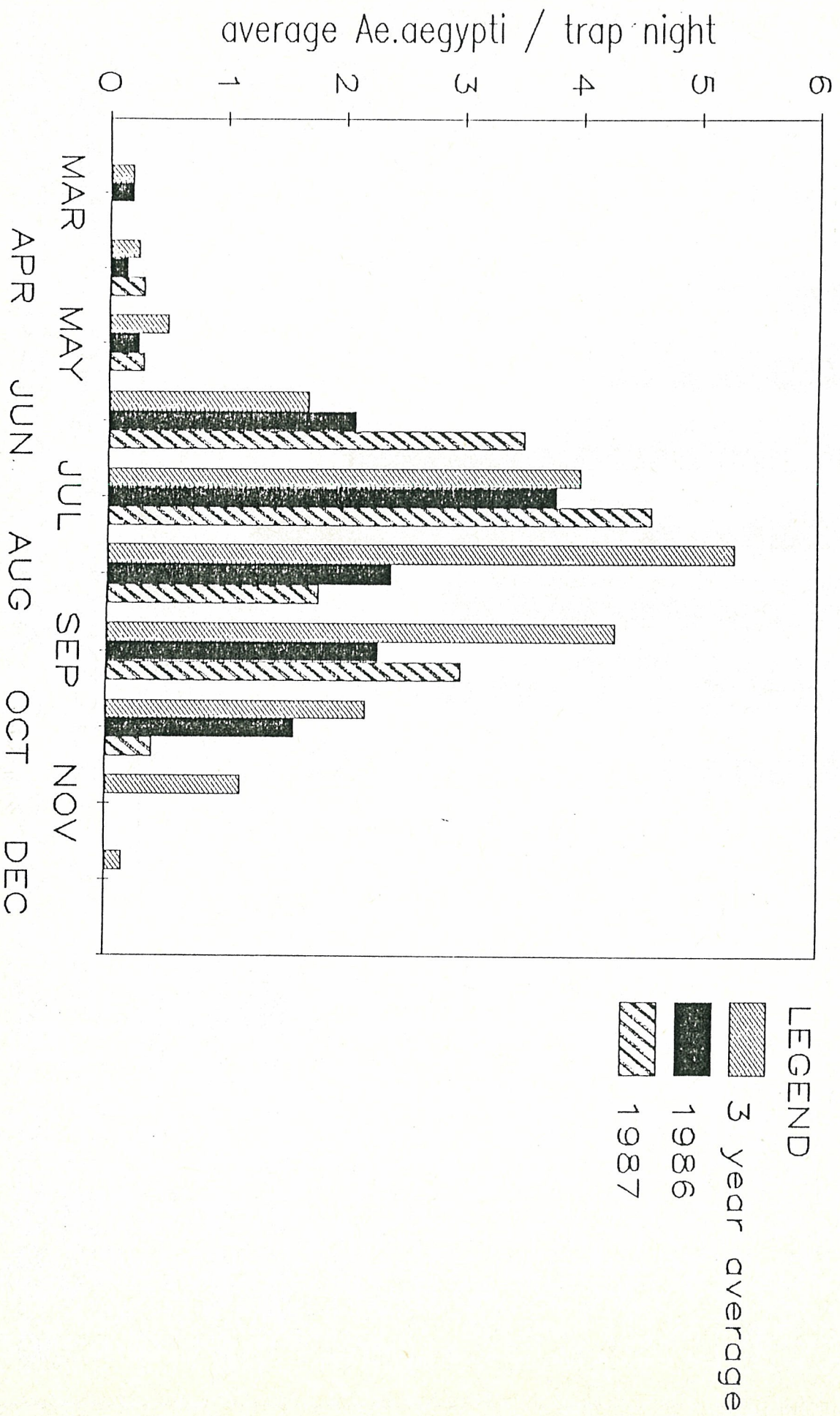
Figures 1-4 illustrate Fay-trap average collections of Aedes aegypti adults and ovipositional activity of major container breeding mosquito vectors. As can be seen, comparing seasonal data from 1986 with last year, there was a single peak of ovitraps positive for Aedes albopictus eggs in August instead of bimodal peaks as in 1986. There is probably no coincidence that Aedes aegypti data from last year for ovitraps and Fay-traps reached their peaks in the month of July. The same situation was observed in 1986 when the Ae. aegypti peak fit between previously mentioned bimodal peaks for Ae. albopictus. These graphs clearly show some influence on each other by two major container breeders and also that Ae. aegypti cannot be replaced by the Asian Tiger mosquito as easy as some suspected.

Again, this year our laboratory cooperated with the Center for Infectious Diseases in Ft. Collins, Colorado in an effort to define the geographical and seasonal distribution of Aedes albopictus.

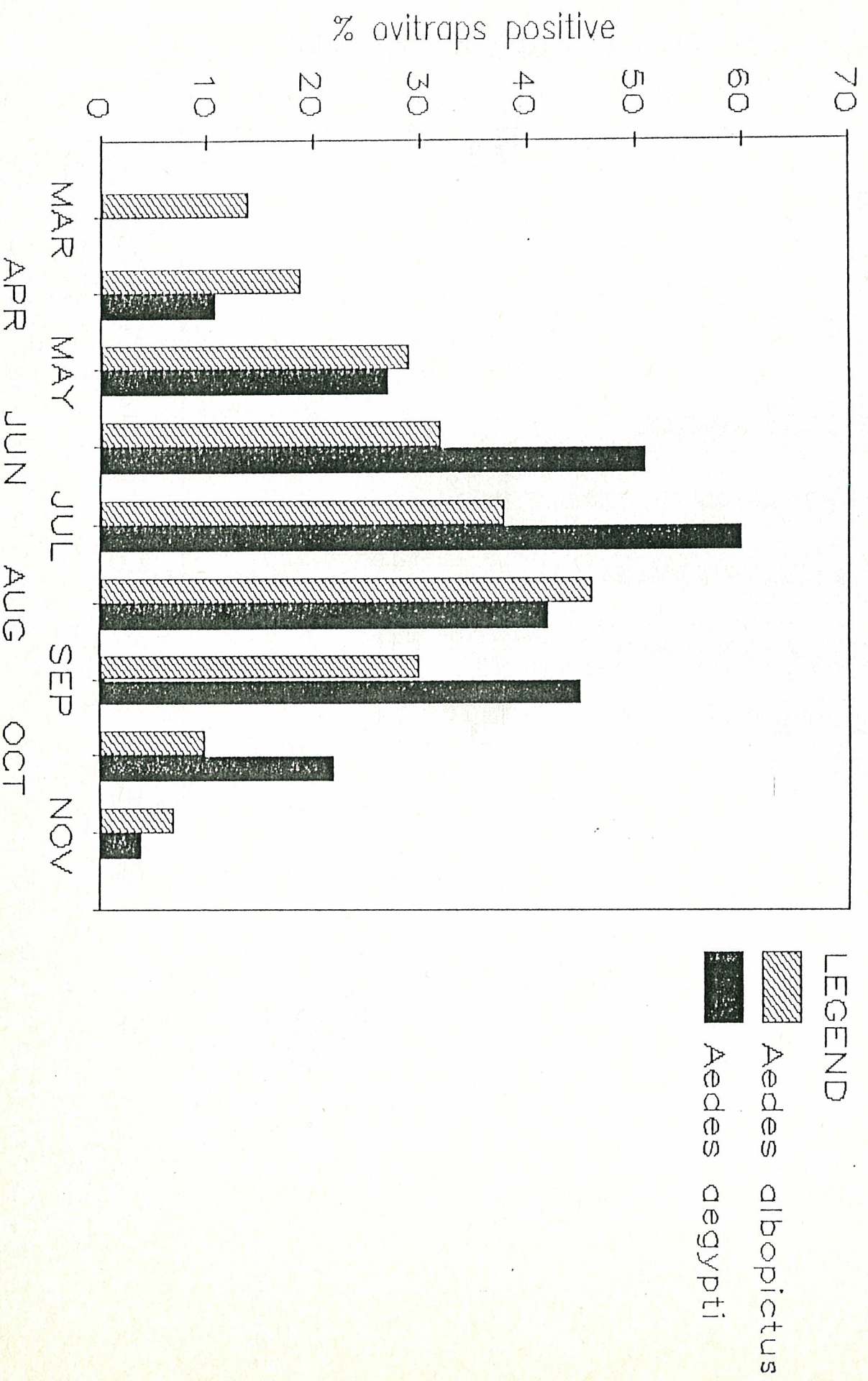
During the summer of 1986, the Center for Infectious Diseases in Ft. Collins, Colorado, and the University of Colorado at Boulder, conducted a survey of Aedes albopictus distribution in the Front Range area. The survey was conducted in a series of trap collections and house inspections. The results of the survey are summarized in the following table:

Location	Number of Traps	Number of Mosquitoes
Fort Collins	10	15
Longmont	10	20
Louisville	10	10
Windsor	10	5
Windsor Park	10	10
Windsor Valley	10	10
Windsor Valley Park	10	10
Windsor Valley Park II	10	10
Windsor Valley Park III	10	10
Windsor Valley Park IV	10	10
Windsor Valley Park V	10	10
Windsor Valley Park VI	10	10
Windsor Valley Park VII	10	10
Windsor Valley Park VIII	10	10
Windsor Valley Park IX	10	10
Windsor Valley Park X	10	10
Windsor Valley Park XI	10	10
Windsor Valley Park XII	10	10
Windsor Valley Park XIII	10	10
Windsor Valley Park XIV	10	10
Windsor Valley Park XV	10	10
Windsor Valley Park XVI	10	10
Windsor Valley Park XVII	10	10
Windsor Valley Park XVIII	10	10
Windsor Valley Park XIX	10	10
Windsor Valley Park XX	10	10
Windsor Valley Park XXI	10	10
Windsor Valley Park XXII	10	10
Windsor Valley Park XXIII	10	10
Windsor Valley Park XXIV	10	10
Windsor Valley Park XXV	10	10
Windsor Valley Park XXVI	10	10
Windsor Valley Park XXVII	10	10
Windsor Valley Park XXVIII	10	10
Windsor Valley Park XXIX	10	10
Windsor Valley Park XXX	10	10
Windsor Valley Park XXXI	10	10
Windsor Valley Park XXXII	10	10
Windsor Valley Park XXXIII	10	10
Windsor Valley Park XXXIV	10	10
Windsor Valley Park XXXV	10	10
Windsor Valley Park XXXVI	10	10
Windsor Valley Park XXXVII	10	10
Windsor Valley Park XXXVIII	10	10
Windsor Valley Park XXXIX	10	10
Windsor Valley Park XL	10	10
Windsor Valley Park XLI	10	10
Windsor Valley Park XLII	10	10
Windsor Valley Park XLIII	10	10
Windsor Valley Park XLIV	10	10
Windsor Valley Park XLV	10	10
Windsor Valley Park XLVI	10	10
Windsor Valley Park XLVII	10	10
Windsor Valley Park XLVIII	10	10
Windsor Valley Park XLIX	10	10
Windsor Valley Park L	10	10
Windsor Valley Park LI	10	10
Windsor Valley Park LII	10	10
Windsor Valley Park LIII	10	10
Windsor Valley Park LIV	10	10
Windsor Valley Park LV	10	10
Windsor Valley Park LVI	10	10
Windsor Valley Park LVII	10	10
Windsor Valley Park LVIII	10	10
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Windsor Valley Park LXI	10	10
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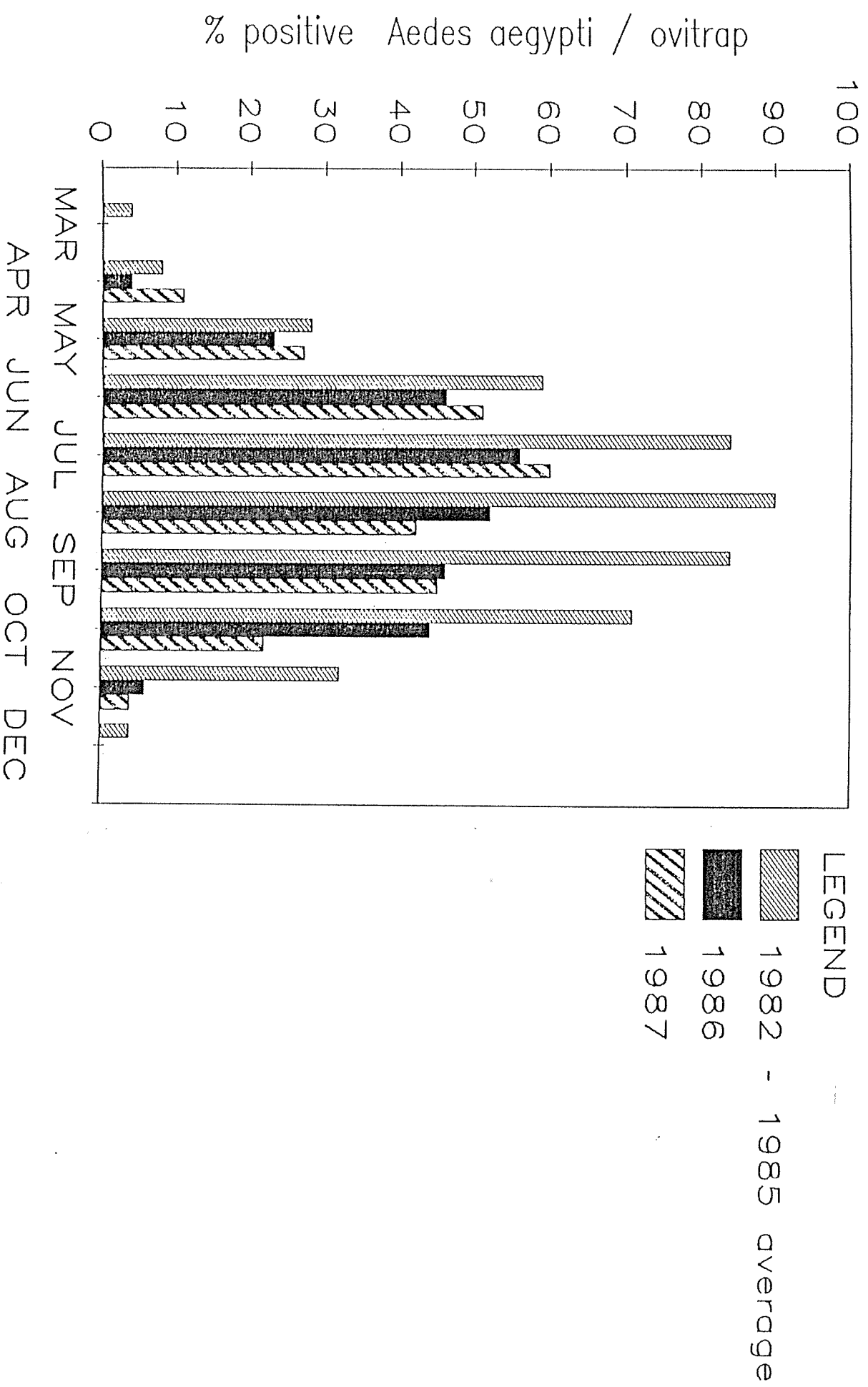
Average numbers of *Aedes aegypti* collected in UV-Fay traps in Orleans Parish in 1983-5, 1986 and 1987



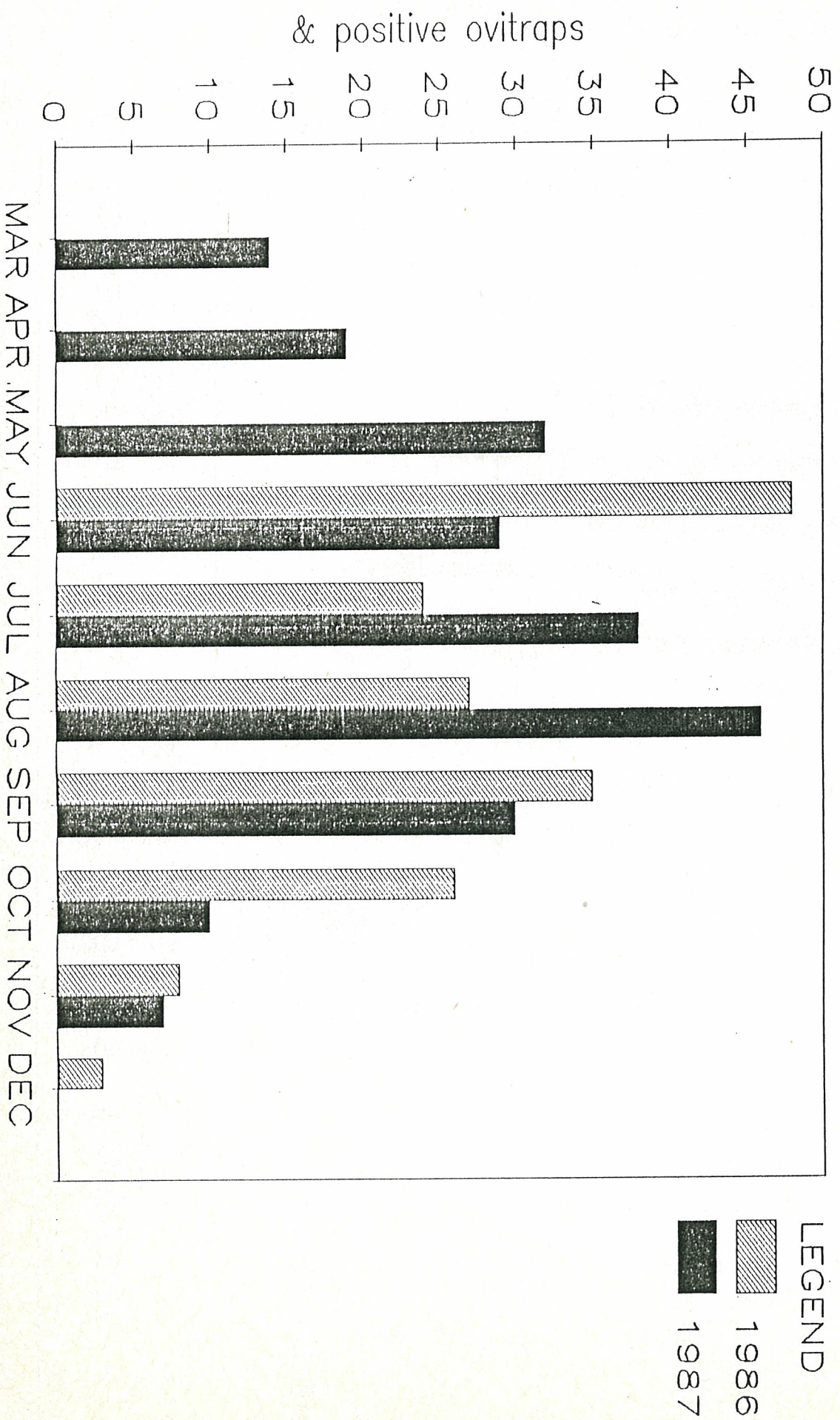
Ovipositional activity of container breeding mosquitoes in Orleans Parish in 1987



Ovipositional activity of *Aedes aegypti* in 1982 - 5, 1986 and 1987



Ovipositional activity of *Aedes albopictus* in surveillance areas of New Orleans in 1986 and 1987



During July and August of 1987, Tx. amboinensis adults were released weekly into a 3.6 acre woodlot located in eastern New Orleans to evaluate their effectiveness against Aedes albopictus in a sylvan habitat. The treatment area, known as Honeyuckle Lane, is bordered by a commercial mint-storage facility to the north, by upper-middle class residences to the east and south, and by a 200 ft. road and median area to the west. Before a detailed examination of the sites, it was presumed that the majority of the adult mosquitoes observed in the woodlot were being produced from containers or treeholes within the lot, and not from residential areas on the perimeter. A wide variety of artificial containers was located within the lot, including 6 tires, 3 five-gallon buckets, 2 washing machines, a 4-foot

FIELD STUDIES

A new strain of Tx. amboinensis was introduced into our insectary from the CDC Laboratory in San Juan, Puerto Rico, to evaluate its ease of rearing and its ability to function as a biocontrol agent in the field.

In general, rearing problems in 1987 were below those of 1986, but several instances of Aedes aegypti larval mortality were observed along with continued erratic egg hatch of all Toxorhynchites species. In-depth studies were implemented in hopes of better understanding the factors that affect successful hatch of eggs. More tests on quality control of the insects were conducted this year than in all the previous years combined.

Additional rearing equipment, including 20 cages for adult mosquitoes and 5 new larval trays (4 ft. x 8 ft.), were fabricated for use in the present insectary to increase the potential for predator production. A series of rearing trials were initiated to evaluate this new equipment in terms of labor reductions and the physical effects upon the insects.

In late 1986, the citizens of New Orleans passed a bond issue which allows for the construction of a Biocontrol/Toxicology Laboratory to be located adjacent to the Michoud Aerospace Center. The primary function of the 7500 sq. ft. facility will be the production of Toxorhynchites for use in the control of container-breeding mosquitoes, but other biologicals as well as insecticides may also be evaluated. The design incorporated the expertise of architects, engineers, entomologists, and mass-rearing specialists to create what we hope to be a very practical and functional rearing facility. Construction of the new laboratory should begin in 1988.

TOXORHYNCHITES REPORT

The number of breeding containers was reduced from 25 on week 0 to only 3 during week 5, indicating that at least 88 % of the sites were no longer producing adult mosquitoes. Even in the 3 containers that were listed as prey-positive, Tox were present, and adult emergence was at

that were typically negative for prey through much of the period. of wet containers that did not receive Tox eggs during weeks 2-5 were sites oviposition sites over those without mosquito larvae. The small proportion quantified that the females tend to select prey-positive containers for in 92% of these vessels. Earlier studies conducted with Tox. amboinensis were observed in 86% of the wet containers, and during weeks 4 and 5, were Tox. amboinensis was introduced into the area. By the end of week 2, Tox These were present in various ratios in 100% of the wet containers before category, are Aedes albopictus, Ae. triseriatus, and Culex quinquefasciatus. Three additional mosquito species, which are included in the prey

during the study. sepioides was eventually displaced by Toxorhynchites amboinensis indigenous to the sylvan habitat of New Orleans. Toxorhynchites found to contain Toxorhynchites rutilus sepioides, the species One week prior to the first release, on week 0, 4 of the 25 wet sites were cause for the decline in the number of wet containers during week number 7; slightly due to human interaction, but lack of rainfall was the primary continued through week 7. The total number of containers fluctuated mosquitoes. Releases were initiated at the beginning of week 1 and held water, and the number of those which supported predators and/or prey Figure 1 illustrates the number of containers within the woodlot that

sufficient to eliminate mosquito emergence. containers such as tires and buckets, 2 fourth-instar Tox are usually equaling a rate of approximately 45 females per acre per week. In typical An average of 160 females were released weekly into the study site,

treatment zone. woodlot, adjacent to the bowling alley approximately 2 miles south of the purposes, 8 additional ovitraps were placed in a similar, but untreated that comb scales of subsequent larvae could be identified. For comparative weekly, the eggs counted and identified, then hatched in a nutrient broth so oviposition rates of the target species. Paddles and water were changed ovitraps were distributed throughout the area at ground level to monitor Four weeks prior to the first release of predators, 12 black plastic

treeholes on 3 occasions during the study, but no wet holes were located. Tox larvae, and larvae of the target species. Ladders were used to examine the study site were examined 3 times per week for the presence of Tox eggs, wading pool, and assorted plastic and metal pails. All containers within

extremely low levels. During week 6, the proportion of predator-positive containers dropped and an increase was observed in the number of prey positives. This was likely due to several rearing problems encountered during weeks 4-7. (See Table 1 "Mortality")

Over the length of the study, however, it was obvious from the hundreds of observations into the containers that the emergence of *Ae. albopictus* and the other container breeders was substantially reduced. Information from the ovitraps, though, was not nearly so supportive.

Ovitraps data (Table 2) was divided into 3 periods for analysis: Period 1, a pre-treatment period to establish a baseline; period 2, an intermediate period to allow predators to reduce adult emergence and for the pre-existing adult population to decline through natural mortality; and period 3, a time in which reductions in oviposition should have been observed. Contrary to the container surveys in which control was visible, no significant reductions in *Ae. albopictus* oviposition could be seen during the treatment period. The mean number of eggs per trap for the 3 periods remained relatively constant in both the Honeyuckle woodlot and the non-treated bowling alley woodlot.

Although a preliminary survey of the residences surrounding the Honeyuckle woodlot did not reveal an abundance of backyard breeding sites, a more thorough search exposed numerous mosquito-producing containers, especially in yards bordering the southern end of the lot where egg counts were the highest. In early August, 20 additional ovitraps were placed in the residential area to monitor mosquito populations adjacent to the treatment zone.

The number of eggs sampled from the residential traps was substantially below that of the 2 woodlots, but 100% of the traps were found to be positive for *Ae. albopictus*. *Aedes albopictus* was well established throughout this affluent residential area, and it is possible that the daily immigration of adults from this periphery into a preferred sylvan habitat may have resulted in an elevated oviposition rate in the woodlot during the study. Dispersal of *Toxorhynchites* out of the woodlot was minimal.

Aedes triseriatus did not have a strong foothold in the residential border, as only 5 to 10% of the ovitraps were positive for this species (Table 3). It is hypothesized that because densities were low in the residential area, good control of *Ae. triseriatus* was observed in the Honeyuckle woodlot. A 97% reduction in the mean number of eggs was observed in the treatment area from period 1 to period 3, while oviposition at the bowling alley remained relatively stable.

In summary, it is fair to say that *Toxorhynchites* was very efficient in locating *Ae. albopictus* breeding sites in the sylvan habitat. Observations into the containers indicated a high degree of control, but for *Ae. albopictus*, at least, ovitrap indices did not. Most likely, the treatment area was too small and immigration from surrounding areas greatly influenced the results.

LABORATORY TESTS

Two species of *Toxorhynchites*, consisting of laboratory strains from 3 different colonies (Table 4), were routinely reared in the insectary and monitored throughout the year to evaluate such factors as fecundity, % egg hatch, numbers of pupae produced per rearing tray, pupal weights, and daily survival of adults. These parameters are extremely important in terms of our ability to produce large numbers of predators for release, and aid in determining the strain that will best meet the needs in the field for a biocontrol operation. A summary of these data is presented from which the following observations are made:

1. **FECUNDITY** - The average number of eggs produced/female/day was calculated by the following methods: 55 pupae from each colony were allowed to emerge into 18" x 18" Plexiglass cages and provided with an oviposition site 24 hours a day. Sex ratios were determined from examination of pupal skins. Dead adults and *Toxorhynchites* eggs were removed and recorded daily. Since predators are typically released 10 days after pupae are removed from the rearing trays and oviposit for 1 week in the field, oviposition rates from days 10-16 were used to calculate fecundity. Results for 1987 indicate that fecundity for all 3 colonies was relatively high when compared to previous years (Table 5). During 1987, *Tx. splendens* and *Tx. amboinensis* (New Orleans colony) were significantly higher in egg production than the *Tx. amboinensis* colony recently brought in from Puerto Rico. An apparent trend towards higher fecundity was observed in the New Orleans colony from 1981 to 1987, as egg production per female has almost doubled (7.6 to 13.3), more closely resembling that of *Tx. splendens*. The cause of this change is not clear, but it is possible that a selection process for higher fecundity is occurring with the mass rearing techniques being utilized. It may also be possible that through human error, a composite *Tx. splendens/amboinensis* colony was created when the wrong species was introduced into a cage or tray. Although earlier studies conducted at NOMCB have indicated that limited hybridization can occur, the 2 colonies still exhibit the morphological differences (color and abdominal tufts and scale patterns) that separate the species.

2. **STOCK RATE TESTS** - During the standard propagation process for the *Toxorhynchites* colonies, pupae were placed into 8 cu.ft. holding cages at rates from 100 to over 1000 pupae per cage to determine the effects of

With the addition of new holding cages for adults, each cohort from a particular rearing cycle was placed into its own cage and monitored for hatch success. In previous years, different cohorts of insects were sometimes combined into the same cage, creating difficulties in evaluating a particular group. Three main cage types were utilized in hatch success studies (Table 6). Included were 18" x 18" cages with plexiglass walls stocked with 55 adults, 18" x 18" screen cages with 55 adults, and 24" x 24" screen cages stocked with 100 to 1000 adults. The egg viability rate was monitored in weekly samples of 48 eggs hatched individually. Hatch success was significantly higher from Tx. *amboinensis* (Puerto Rico colony) than the other 2 colonies in both the plexiglass and the 24" screen cages. As with fecundity, no significant differences were observed between Tx. *amboinensis* (New Orleans colony) and Tx. *splendens* with regard to hatch. Egg hatch from adults held in screen cages was significantly below that of adults held in plexiglass cages (for all colonies). One of the few variables different in the 2 cage types is humidity; screen cages rely on moisture supplied by a room humidifier (typical range 75-85% RH) while the plexiglass cages trap moisture from the oviposition jars and maintain a more constant humidity of 90-100%. Plexiglass cages may also serve as a barrier to prevent contaminants from interacting with adults. Studies on the influence of humidity upon hatch success are still in progress.

3. EGG HATCH SUCCESS - A predictable rate of hatch for *Toxorhynchites* eggs is important for several reasons. First, large fluctuations in hatch from week to week can wreak havoc on larval rearing schedules, creating excess prey (and potential emergence of biting adults) when hatch is too low, or contributing to increased predator cannibalism when hatch is too far above normal. Sufficient egg viability from females released into the field is mandatory if control of the target species is to be realized.

1000, were minimal. Similar stocking rates, and the number of samples at the upper end, i.e. relationship, though, for egg production was highly variable even within pupae placed into the cage. This analysis may not indicate the true (Puerto Rico colony) indicate a reduction of ca. 1 egg/female for every 100 regression analysis of the data for both Tx. *splendens* and Tx. *amboinensis* within the Tx. *amboinensis* (New Orleans colony) at the varied stocking rate, rate. Although no significant difference in oviposition were observed eggs produced per female over the 3 week period with respect to stocking measured the following day. Figures 2-4 illustrate the average number of adults/cage. Typically, females from each cage were egged for ca. 4 hours every Monday for 3 weeks, and the total number of eggs was volumetrically stocking rate upon egg production and hopefully establish optimum numbers of

4. PUPAL WEIGHTS - Using similar rearing techniques, pupae from the Tx. amboinensis (Puerto Rico colony) are consistently larger than those from the other 2 colonies (Table 5). In many insect rearing programs, creating larger insects has proved advantageous, but we have yet to demonstrate any superiority within a species by virtue of pupal weights alone.

5. SURVIVAL - No significant differences were observed in the number of females alive between 10 and 16 days (after pupae were removed from rearing trays) from the 3 different colonies (Table 5). These data agree with survival information obtained from previous years.

CONCLUSIONS - With the limited manpower and rearing space at the present facility, no more than 1 colony of Toxorhynchites can be produced in sufficient numbers to meet the demands of a large scale field trial. It would appear that although no colony was outstanding in all of the aforementioned quality control parameters, one will be selected as the species of choice and elevated to maximum rearing capacity for release against container-breeding mosquitoes in 1988. The choice is not an easy one - Tx. splendens demonstrated the highest fecundity, but was highly variable in % egg hatch, while Tx. amboinensis (Puerto Rico colony) consistently demonstrated the greatest percentage of viable eggs and the lowest fecundity. In comparing the 2 strains of Tx. amboinensis, it is apparent that there are significant differences in pupal weights, fecundity and % egg hatch. If such differences exist within a species, it would seem logical that among the 69 recognized species of Toxorhynchites around the world, a strain exists which is superior to the ones evaluated to date.

In every major field trial conducted with Toxorhynchites in New Orleans, the colony utilized had been maintained under laboratory conditions for 5-10 years, and was originally established for virological studies (as opposed to a biological control agent). Even without the benefits of an elaborate strain selection process or highly trained technical staff, releases of Toxorhynchites into our urban area have proved successful enough to expand the project. One can only speculate the impact that this predator might have upon targeted mosquito populations and disease transmission if a team including geneticists, insect pathologists, and mass rearing specialists were to coordinate and combine their efforts. Integration of control methodologies, including chemical, biological, physical, and social awareness are mandatory if control of container breeding mosquitoes is to be realized.

TABLE 1:

Q.C. PARAMETERS DURING FIELD RELEASES

QUALITY CONTROL

IX. AMBOINENSIS (PUERTO RICO COLONY)

RELEASE NO.	PRE-RELEASE MORTALITY (%) ¹	% MATED	% EGG HATCH
1	11	100	75
2	8	100	81
3	6	100	--
4	33	78	77
5	35	80	81
6	29	100	90
7	22	85	89

¹ PRE-RELEASE MORTALITY SHOULD AVERAGE 10% OR BELOW

TABLE 2: MEAN NUMBER OF AEDES ALBOPICTUS EGGS/OVITRAP/WEEK

PERIOD	SAMPLING WEEK	HONEYSUCKLE WOODLOT	BOWLING ALLEY WOODLOT	HONEYSUCKLE RESIDENCES
I	6/23/87	347 (± 204)	134 (± 51)	NA
	7/01	206 (± 136)	87 (± 54)	NA
	7/08	345 (± 231)	151 (± 79)	NA
	7/15	198 (± 141)	130 (± 86)	NA
	MEAN =	274 (± 178)	126 (± 68)	
II	7/22	251 (± 184)	139 (± 76)	NA
	7/29	335 (± 259)	187 (± 91)	NA
	8/05	194 (± 109)	81 (± 55)	NA
	MEAN =	260 (± 184)	135 (± 74)	
	8/12	278 (± 157)	138 (± 52)	77 (± 48)
III	8/19	351 (± 223)	74 (± 60)	36 (± 36)
	8/26	132 (± 92)	182 (± 99)	36 (± 30)
	MEAN =	254 (± 157)	131 (± 70)	50 (± 38)

TABLE 3: MEAN NUMBER OF AEDES TRISERIATUS
EGGS/OVITRAP/WEEK

PERIOD	SAMPLING WEEK	HONEYSUCKLE WOODLOT	BOWLING ALLEY WOODLOT	HONEYSUCKLE RESIDENCES
		$\bar{x}$ EGGS ($\pm$ SD)	$\bar{x}$ EGGS ($\pm$ SD)	$\bar{x}$ EGGS ($\pm$ SD)
I	6/23/87	53 ($\pm$ 58)	55 ($\pm$ 57)	NA
	7/01	26 ($\pm$ 35)	10 ($\pm$ 27)	NA
	7/08	117 ($\pm$ 105)	71 ($\pm$ 68)	NA
	7/15	52 ($\pm$ 35)	43 ($\pm$ 81)	NA
	MEAN =	62 ($\pm$ 58)	45 ($\pm$ 58)	
II	7/22	68 ($\pm$ 58)	49 ($\pm$ 62)	NA
	7/29	33 ($\pm$ 34)	54 ($\pm$ 38)	NA
	8/05	37 ($\pm$ 43)	11 ($\pm$ 18)	NA
	MEAN =	46 ($\pm$ 45)	38 ($\pm$ 39)	
III	8/12	3 ($\pm$ 6)	41 ($\pm$ 37)	8 ($\pm$ 23)
	8/19	0 ($\pm$ 0)	49 ($\pm$ 35)	9 ($\pm$ 23)
	8/26	2 ($\pm$ 7)	49 ($\pm$ 58)	3 ($\pm$ 15)
	MEAN =	2 ($\pm$ 4)	46 ($\pm$ 43)	7 ($\pm$ 20)

TABLE 4:

TOXORHYNCHITES COLONY DERIVATION

Species	Designation	Derived from (Date)	
1. <u>Tx. amboinensis</u>	New Orleans Colony	LSU New Orleans, Louisiana (1980)	Philippines
2. <u>Tx. amboinensis</u>	Puerto Rico Colony	CDC San Juan, Puerto Rico (1987)	Philippines
3. <u>Tx. splendens</u>		Univ. of Notre Dame (1983) Notre Dame, Indiana	Burma

All material was previously colonized at the Pacific Bio Medical Research Center, Honolulu, Hawaii

TABLE 5: Toxorhynchites Fecundity - 1981-1987

	<u>Tx. splendens</u>	<u>Tx. amboinensis</u> (New Orleans colony)	<u>Tx. amboinensis</u> (Puerto Rico colony)	<u>Tx. amboinensis</u> (Wild Strain Makiki, Hawaii)
1981		7.6 ¹ (2.5) ²		
1982		8.0 (3.9)		
1983	12.6 (3.9)	6.0 (3.4)		9.1 (4.6)
1984	12.6 (4.3)	8.6 (3.8)		
1985	12.8 (2.9)	10.0 (2.5)		
1986	12.7 (4.9)	13.3 (2.6)		
1987	15.7 (3.1)	13.3 (4.3)	10.7 (3.0)	

¹ Mean no. eggs/female/day (based upon 7 day average from days 10-16 post pick of pupae from trays)

² Standard error

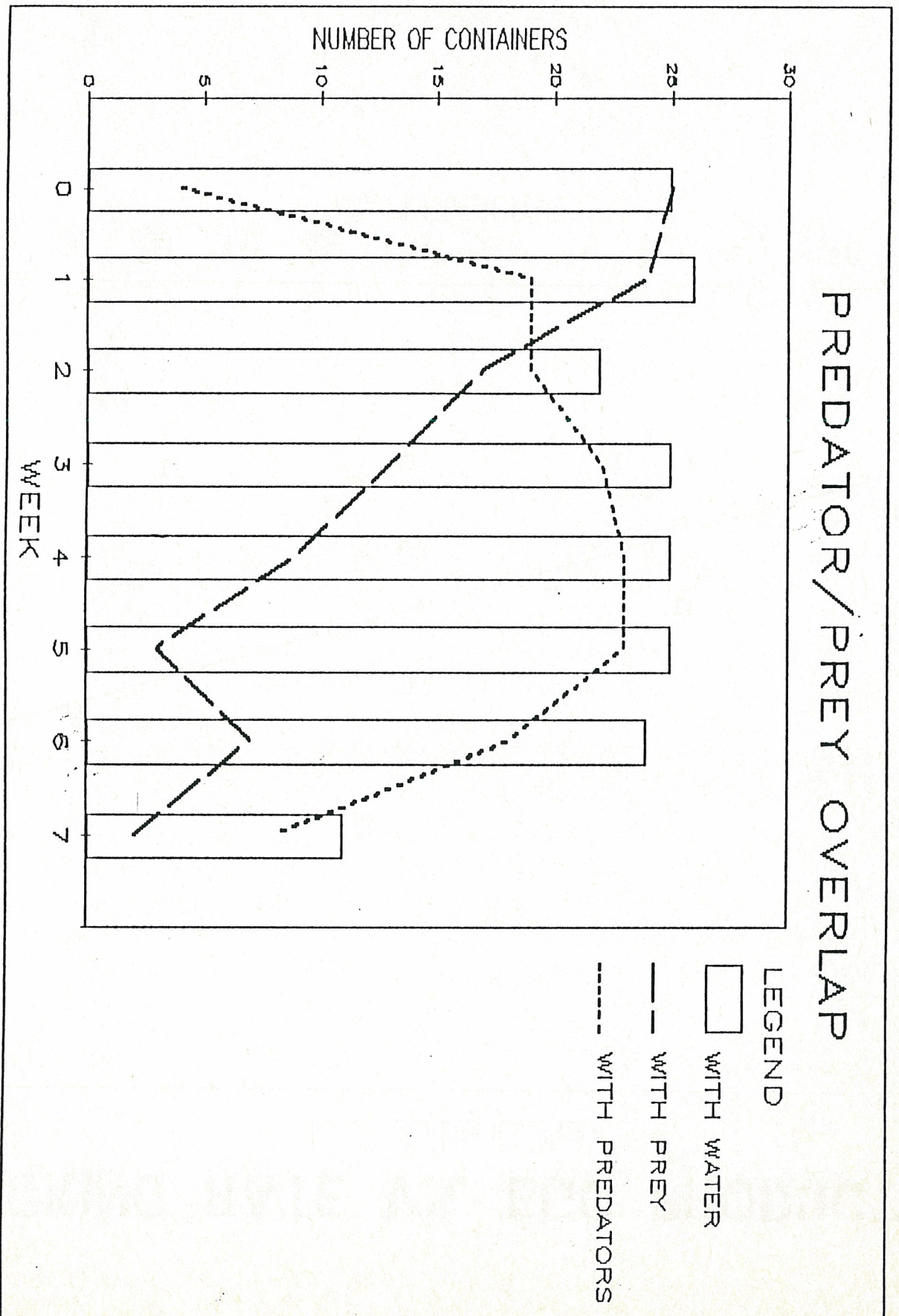
TABLE 6: 1987 Quality Control Parameters

	<u>Tx. amboinensis</u> (Puerto Rico colony)		<u>Tx. amboinensis</u> (New Orleans colony)		<u>Tx. splendens</u>	
% Hatch	$\bar{x}$	(S.D.) N	$\bar{x}$	(S.D.) N	$\bar{x}$	(S.D.) N
18" Plexiglass Cages	78.9	(20.7) 18	59.8	(18.9) 19	65.9	(17.8) 19
24" Screen Cages	63.2	(16.6) 50	48.1	(16.9) 48	48.6	(18.4) 65
18" Screen Cages	54.7	(33.7) 9	NA		44.4	(26.7) 10
Pupal Weights (mg/pupa)	44.9	(2.2) 4	41.5	(1.2) 61	39.4	(1.1) 70
Survival *	21.6	(6.1) 10	25.1	(4.7) 8	25.6	(4.6) 10

* No. females alive from 55 pupae 10 days "post-pick"

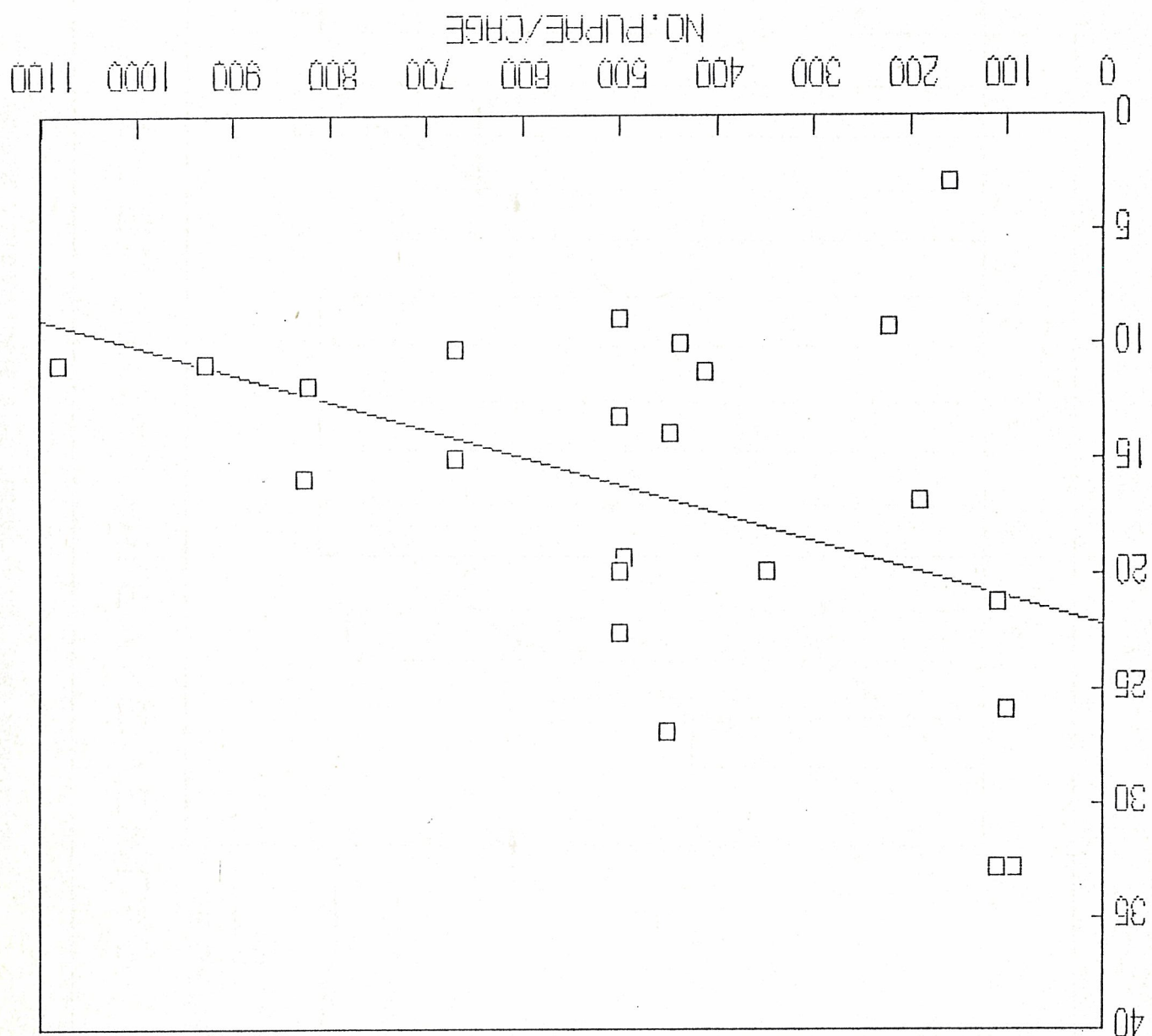
FIGURE 1:

NUMBER OF CONTAINERS WITH PREDATOR AND PREY MOSQUITOES



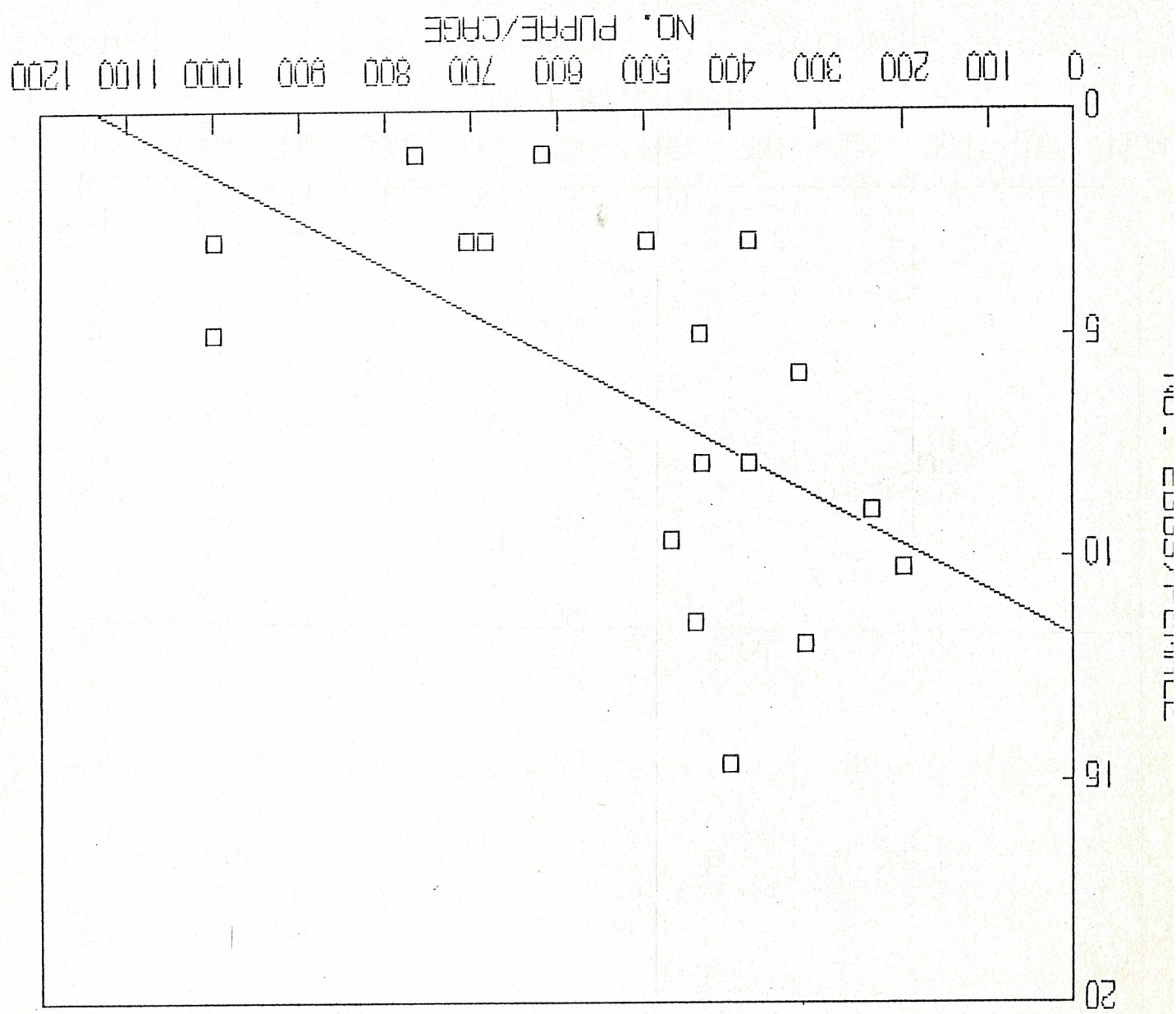
STOCKING RATE VS. EGG PRODUCTION

Tx. splendens



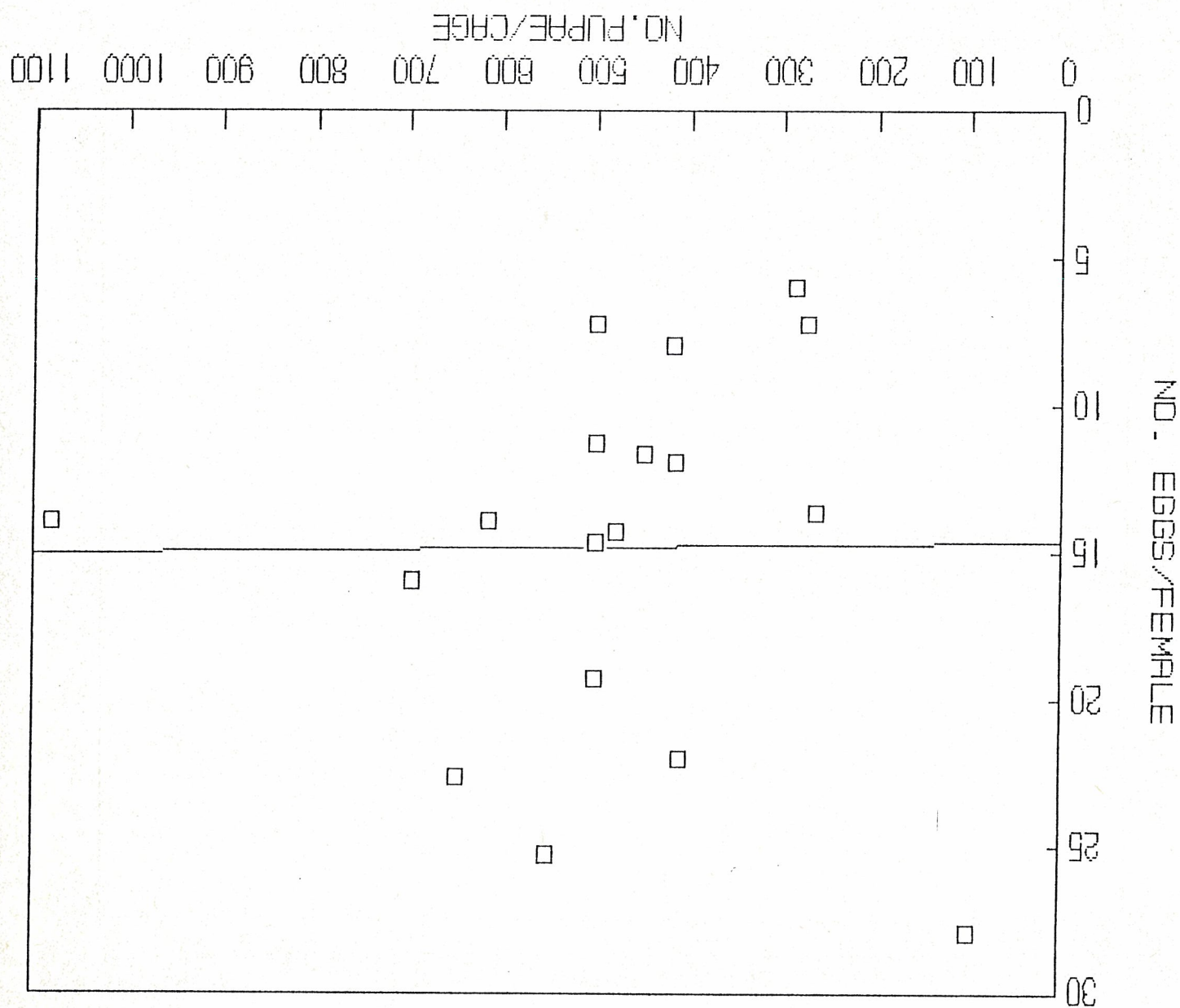
STOCKING RATE VS. EGG PRODUCTION

Tx. ambloinensis (Puerto Rico colony)



STOCKING RATE VS. EGG PRODUCTION

Tx. amboinensis (New Orleans colony)



ENCEPHALITIS SURVEILLANCE

Surveillance was begun in May with the deployment of seventeen walk-in sparrow traps. These traps, located in backyards throughout Orleans Parish were normally run five days per week. From June through September the traps were operated seven days per week.

Mist nets were used twice each week to capture birds in areas where traps were inappropriate.

Microtainer brand serum separators were used this year instead of glass vials. The blood is transferred from the syringe directly into the microtainer, centrifuged, and sent to the lab. Use of serum separators reduced the percentage of samples unusable due to clots to 0.5%.

The state lab began using the ELISA test this year. This test is more sensitive than the Hemagglutination Inhibition test and requires less blood. The smaller amount of blood is easier for the phlebotomist to obtain, and especially kind to the birds.

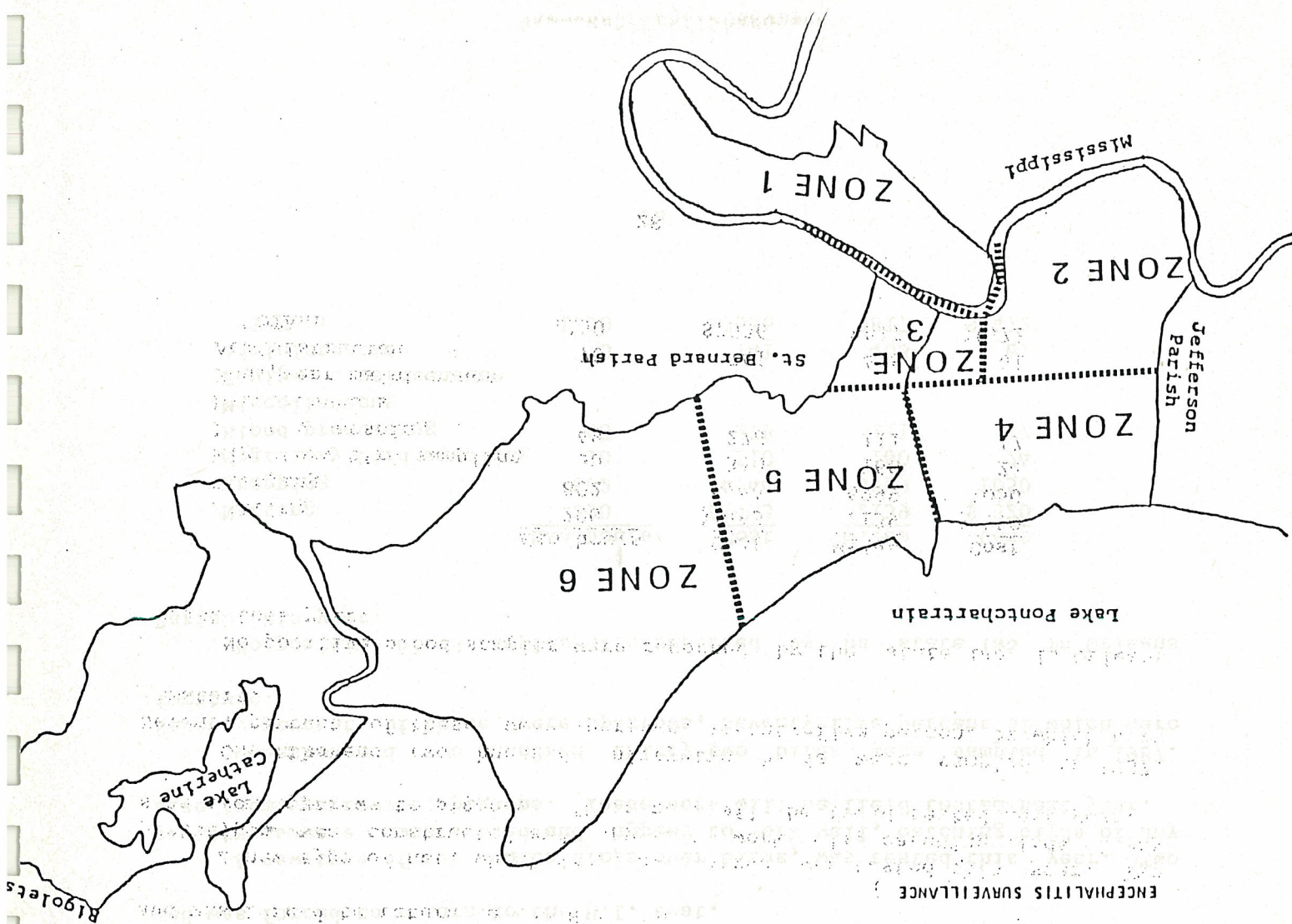
Unfortunately, the lab was unable to obtain diluent for the new test, and was forced to return to the H.I. test.

A new type of net, which drops over birds, was tested this year. Two prototypes were constructed and appear to work well, catching birds of any size from sparrows to pigeons. These nets will be field tested next year.

One thousand two hundred thirty-two birds were sampled in 1987. Seventy percent of these were sparrows, seventy-five percent of which were immature.

No positive blood samples were reported by the state lab in Orleans Parish this year.

	Man hours	Cost	Miles	Cost
Netting	200	\$1463	2139	\$ 320
Trapping	802	4744	6999	1050
Migratory bird sampling	30	310	160	24
Blood processing	48	278	111	17
Miscellaneous				
Equipment maintenance	70	741	408	61
Administration				
TOTAL:	1150	\$7536	9817	\$1472



	SPARROWS		OTHER	
	Total	Adults	Immatures	Adults
Zone 1	193	48	80	37
Zone 2	188	42	141	2
Zone 3	199	41	115	25
Zone 4	151	37	82	16
Zone 5	96	10	39	26
Zone 6	405	37	197	118
TOTAL	1232	215	654	224
# Pos/ % Pos	0/0	0/0	0/0	0/0

AVIATION OPERATIONS

Both of our aircraft received the FAA 100 hour/Annual Inspections required for certified aircraft. The inspections were performed during the early months of the year, and were followed by operational and calibration tests of the chemical delivery systems on both ships.

A blind altitude encoding device was installed on the Britten-Norman aircraft in our aviation shop. This equipment is required by FAA for aircraft which fly in Terminal Control Areas and had to be in operation before December 31, 1987.

Two full wing span spray booms were designed, fabricated and installed on the Grumman aircraft in our aviation shop. These booms will support six nozzles on each wing. The additional nozzles, which can be operated in any combination, will enable us to have more flexibility with respect to swath width, swath shape, and increased application rate. Additionally, this nozzle configuration is particularly useful for research of application chemicals.

In addition to the above item, two other pieces of ancillary equipment were designed and fabricated in our aviation shop to be used as support equipment in the aerial program. One is a portable loading cart that has a high volume pump which can be used to load chemicals at remote sites. The pump can be driven by either a 115 V A/C motor or alternatively by a small gasoline engine.

The other unit designed and fabricated here is a high pressure pump aircraft washer driven by a 115 V A/C motor. It is useful for dislodging insects which impinge on the airframe during spray operations and are difficult to remove with water at normal pressure.

Twenty-two flights were accomplished with the twin-engine aircraft. Twenty-one were for adulticide purposes and one flight was for maintenance tests and proficiency. Six of the adulticide flights involved Scourge insecticide swath width and droplet analysis.

There were two occasions when it was necessary to use rental aircraft for aerial survey of breeding sites. A helicopter was rented on one occasion to do special photography which was not possible in a fixed-wing aircraft.

This department met with Sprague and Associates Architects on three occasions during the past year to work out details on plans for the aircraft hangar project. The building site has been approved by all parties and construction should commence sometime in 1988.

SOURCE REDUCTION

For most of 1987 the source reduction program was active with inner city projects, new ditch construction within City Park and New Orleans east, combined with old ditch maintenance for added adult mosquito reduction for the residents of surrounding residential areas.

Area U-24 (Almonaster Road, Old Gentilly Road, Paris Road, Intercoastal Waterway, Grant Street) was drained via an existing pipe under Grant Street, into a Sewerage and Water Board canal. This will help reduce mosquito populations in this growing industrial area. Other areas in New Orleans east (U-12, U-4, S-21, W-9, U-24, U-15, Q-8) received new ditches or routine maintenance by removal of dense, obstructive vegetation. Intense inspection of the lower coast of Algiers revealed possible projects near the English Turn Golf Course which will be scheduled during the year, and monitoring of this area will continue throughout 1988.

The W-2 Wetlands project has been placed on "hold" pending the institution of the Bayou Sauvage National Wildlife Refuge. Amphibious ditching of the "W" areas east of Paris Road was halted in 1986 until further notice. Ditching of these areas is important to eastern New Orleans because of the location close to homes, schools and shopping areas.

Backhoe	I & H	DL-1	Ditcher	Crawler	Ditch Maintenance
280	29	16	201	220	

Total hours	174	2085	2782	\$5378.80	\$ 557.00	\$ 308.00	\$3861.21	\$4226.20
Digging hours								
% Digging time								
Linear feet/ditch								
Cubic yards dug								
Salary								
Cost of fuel,								
oil, maintenance								
TOTAL COST:								

Cost/Ft.	\$ 2.71
Cost/Yd3	\$ 2.03

* Preventative maintenance

Source Reduction

Service support		Vehicles		Traveled		Cost	
Miles							
S-12	7484	\$	1122				
S-13	1522	\$	266				
DT-95	1065	\$	160				
S-19	50	\$	10				

PUBLIC EDUCATION

Access to video production equipment was obtained through the City Public Information Office early in 1987. This allowed the production of new programs and revision of existing ones without the cost of renting equipment. The equipment, housed in a mobile production van, was eventually moved to the Mosquito Control Board's facility where it has easy access to 110V A/C power and is parked under an overhang next to a meeting room which can be used as a studio.

The chemical safety program, "Recognition and Management of Pesticide Poisoning" originally produced in 1982 was completely remade in order to incorporate new information. This program explains the hazards of pesticides, particularly organophosphate and pyrethroids, and provides information on treatment of overexposure to these chemicals. Our ultra low volume spray truck operators and chemical handlers are required to view this tape annually.

A program entitled "Old Tire Casings, A National Health and Sanitation Problem" was also produced this year. This program deals with the problem of old tires, and shows several possible solutions.

Mosquito video tape from NOMCB was used in a program which was shown on Home Box Office on October 15, 1987. The program was about AIDS and was hosted by the surgeon general.

Translation of our video programs into Spanish was begun this year. Our entomologist, Ed Freytag, is doing both the translations and the Spanish narration. Two tapes have been translated at present. They are "The Mosquito Problem" and "Aedes Albopictus the Asian Tiger Mosquito".

The pamphlet "Mosquito Control in New Orleans" was reprinted. This pamphlet is used for school and civic group presentations, and is the core of the teacher's guides to our school programs. A "doorhanger" was also printed for our inspectors to leave at residences when occupants are not in.

Public education : 571
Photography & processing : 397
Equipment maintenance : 55
TOTAL: 1023
\$8492
4127 \$ 619
76 11
1044 157
3007 \$ 451
Cost Miles Cost

Distribution of our programs to schools in the future will be greatly simplified by the School Board's Cable-TV channel which has recently begun operating. Channel 48 has copies of several of our programs and is scheduling them for cablecast. In addition, since these tapes are in their library, the School Board will provide copies to schools not connected to the cable system. Copies of our programs have also been provided to the Government Access channel, which has cablecast them several times, and to the new Orleans Public Library where they are available for loan.

Distribution of tapes was done by hand delivery again this year, since the mail out that was attempted last year yielded very poor results. The 36 schools which did give a response, showed the tapes a total of 228 times to 6,515 students. The average class size was 29 students and each tape was played on average of 7.3 times.

Distribution of our video programs to Orleans Parish schools continued for the third year. It is difficult to estimate the number of students who viewed these programs during the year. Although the tapes were distributed to 74 middle and high schools, only 48% of these schools actually filled out the feedback sheet which accompanied each tape. Verbal communications with the schools indicate that a greater percentage use the programs, but failed to provide us with any information on attendance.

The 36 schools which did give a response, showed the tapes a total of 228 times to 6,515 students. The average class size was 29 students and each tape was played on average of 7.3 times.

The fire departments in our area were given a tour of the facility, a lecture and videotape on chemical safety.

The New Orleans Fire Department.

There were many visitors to our facility, some of these were, several high schools, classes from Tulane, the Lakefront Airport Safety Section, and Tulane Universities, and the New Orleans East Rotary Club.

Lectures and slide or video presentations were made to several groups during the year, such as: Environmental Health classes at Dillard and

A representative of the World Health Organization was interested in vector resistance to pesticides. NOMCB may do some resistance testing in the future for WHO.

There were numerous international visitors who came to New Orleans for training or exchange of information.

In the future, these tapes will be sold to help defray the cost of their production. Prices are \$35. per tape (VHS or BETA), payable to New Orleans Mosquito Control Board.

Organizations, Companies:

Childrens TV Workshop (3-2-1-Contact)
Chevron Chemical
Zoecon
Clarke Outdoor Spraying
CDC A-V Productions
Pilatus Britten-Norman Ltd.
PanAmerican Health
P.O.P. Pest Management Bd.

Countries:

Panama
Trinidad
Honduras
Saudi Arabia
United Kingdom
Switzerland
Italy
Dominican Republic
Brazil

Universities:

University of Kentucky
University of So. Carolina
Rutgers University
No. Carolina State Univ.
Texas Tech University
University of Florida
Louisiana State University
Virginia Polytechnic Institute
Penn State University
Notre Dame University

Cities:

Gainesville, Florida
Kinder, Louisiana
Baton Rouge, Louisiana
Farmers Branch, Texas
Osprey, Florida
Albuquerque, New Mexico
Mobile, Alabama
Saginaw Bay, Michigan
Lake Charles, Louisiana

The following is a list of some of those who requested tapes:

Copies of some of our videotape programs have been sent to many organizations, cities, and countries around the world.

Содержание: 1. Общие сведения о предприятии. 2. Описание продукции. 3. Анализ рынка. 4. Финансовый анализ. 5. Заключение.

Содержание

1. **Prevalence of disease** (e.g. 10% of the population have the disease)
 2. **Prevalence of disease** (e.g. 10% of the population have the disease)
 3. **Prevalence of disease** (e.g. 10% of the population have the disease)
 4. **Prevalence of disease** (e.g. 10% of the population have the disease)
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 9. **Prevalence of disease** (e.g. 10% of the population have the disease)
 10. **Prevalence of disease** (e.g. 10% of the population have the disease)

methods to control Aedes aegypti and Aedes albopictus.

The government of Puerto Cortes, Honduras sent several representatives