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EFFECTS OF SALT MARSH IMPOUNDMENTS ON MOSQUITO POPULATIONS

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ABSTRACT

Four impoundments constructed in areas of irregularly flooded salt marsh in Carteret and Pamlico Counties, North Carolina were studied to determine the effects of this type of water management on mosquito production. The principal species of mosquitoes present in the study areas were Aedes taeniorhynchus (Weidemann), A. sollicitans (Walker), Anopheles bradleyi King, An. atropos Dyar and Knab and Culex salinarius Coquillett.

Breeding sites within the study areas in Carteret County differed from those in Pamlico County in their vegetational makeup, and in the size and species composition of their mosquito populations. The effects of the impoundments on these different situations, however, were similar.

Large patches of Distichlis spicata (L.) and Spartina patens (Aiton) interspersed throughout the unimpounded marsh dominated by Juncus roemerianus Scheele, were often eliminated after the installation of an impoundment. J. roemerianus was, in most cases, also destroyed after flooding, remaining in the impoundment in large dead stands. In Pamlico County, however, a large stand of J. roemerianus did continue to thrive in one impoundment. Ruppia maritima L., or widgeon grass was the dominant plant species in the Pamlico County impoundments. Very little Ruppia was found in the Carteret County impoundment during the time of this study. There was, however, an invasion of Typha L. into a few isolated sections of this impoundment.

Both Aedes species, at times exceedingly abundant in the unimpounded marsh sites, especially in Pamlico County, were absent from the impoundments. Only C. salinarius and An. bradleyi, in comparatively low numbers, were present in the impounded marsh. These species were most often collected from those regions of thickest vegetation, such as the few remaining live patches of D. spicata and S. patens near the perimeter of the impoundment, and in combinations

of J. roemerianus and R. maritima situated in regions where the water depth was less than one foot. C. salinarius was also collected from five muskrat holes located on the dikes enclosing impoundments Nos. 1 and 2 in Pamlico County.

It was found that at water depths greater than one foot, vegetation was submerged and/or dispersed sufficiently to eliminate the conditions conducive to Anopheles and Culex breeding.

The salinity of the water in the impoundments was somewhat higher in those in Pamlico County than in the one at Smyrna Creek in Carteret County. This difference however, did not seem to affect the populations of permanent pool breeders found in the impoundments in either county.

Light trap and biting count data collected for the principal salt marsh species showed that although A. taeniorhynchus and A. sollicitans were the most prevalent species at Davis in Carteret County, substantial numbers of Anopheles mosquitoes were also taken. In Pamlico County, A. taeniorhynchus and An. bradleyi were the most commonly collected species in the light traps, however, only the former species was the most commonly collected during biting counts.

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SUMMARY

A large percentage of the approximately 300,000 acres of coastal wetlands in North Carolina consists of salt marsh flooded irregularly by tidal waters and dominated by the plant species Juncus roemerianus (black needlerush). These marshes are capable of producing the species of mosquitoes which are often extremely annoying to man. Since the early to mid 1960's, several impoundments have been constructed to reduce mosquito production. The present study was conducted to determine the effectiveness of this control effort and to provide guidance for its improvement.

Four impoundments, one located in Carteret County and 3 located in Pamlico County were utilized for this study. Adjacent or nearby tracts of natural, unimpounded marsh were used as a basis for comparison. In Carteret County, most breeding sites located within the unimpounded marsh were predominantly vegetated with J. roemerianus, usually matted down to form open areas. In Pamlico County, most sites consisted largely of D. spicata and S. patens.

The principal species of mosquitoes present were A. taeniorhynchus, A. sollicitans, An. bradleyi, An. atropos and C. salinarius. Present in lesser numbers were A. atlanticus Dyar and Knab and Psorophora confinnis (Lynch Arribalzaga). Although all of these are coastal pest mosquitoes, A. taeniorhynchus and A. sollicitans constitute the principal problem, since they are both capable of occurring in tremendous numbers and of dispersing many miles from their breeding sites. The Anopheles and Culex species are produced in lesser numbers and are only locally annoying. Psorophora have habits and capabilities similar to Aedes but, since they are principally fresh water breeders, are not that abundant in our coastal areas.

The Anopheles and Culex mosquitoes are permanent pool breeders and are more consistent and numerous in their presence when there is an extended availability of water. Conversely, Aedes and Psorophora are produced only in temporary or intermittent pools since their eggs are laid on wet soil and must undergo a dry period and a subsequent flooding before they will hatch.

Based upon the unimpounded marsh areas studied in both counties, the research reported on here disclosed that the Juncus marshes in Carteret County were subjected to a much higher rate of tidal flooding for most of the mosquito breeding season than the marshes studied in Pamlico County. Consequently, a much lower level of Aedes breeding was found to occur in the former area than in the latter. The higher flooding frequency probably accounted for the presence of Anopheles and Culex mosquitoes which were as abundant or more so than the Aedes. The relatively high abundance of Anopheles and Culex mosquitoes collected in Carteret County was further demonstrated by the light trap and biting count data. The much larger mosquito population found in the unimpounded marsh area in Pamlico County consisted predominantly of A. taeniorhynchus and A. sollicitans. According to light trap and biting count data for this county, A. taeniorhynchus was, overall, the most commonly collected species during the months of this study.

Despite the above differences in the flooding frequency and mosquito abundance, the effects of the impoundments on these types of marshes were generally the same.

Practically all areas of D. spicata and S. patens within the study areas were eliminated after the construction of the impoundments. J. roemerianus, in most cases, was also destroyed, remaining in the impoundments in large, dead stands. R. maritima was the dominant plant species in the Pamlico County impoundments. Very little Ruppia was found in the Carteret County impoundment during the time of this study, however, an invasion of Typha did occur in this

impoundment in a few isolated sections.

Both Aedes species, at times very abundant in the unimpounded marsh sites, especially in Pamlico County, were absent from the impoundments. Only C. salinarius and An. bradleyi were, in comparatively low numbers, present in the impounded marsh. These species were most often collected from those regions of thickest vegetation, such as from the few remaining patches of live D. spicata and S. patens near the perimeter of the impoundment and in combinations of J. roemerianus and R. maritima situated in regions where the water depth was below the one foot level. C. salinarius was also collected from 5 muskrat holes located on the dikes enclosing impoundments Nos. 1 and 2 in Pamlico County.

It was found that at water depths greater than one foot, vegetation was submerged or dispersed sufficiently to eliminate the conditions conducive to Anopheles and Culex breeding.

The salinity of the water in the impoundments was somewhat higher in Pamlico County than in Carteret County. This difference, however, did not seem to effect the species composition of the populations of permanent pool breeders found in the impoundments.

Although the research findings show impoundments to be effective in reducing salt marsh Aedes populations, it must be emphasized that such permanent control measures should be employed only where necessary.

In view of the finding that large areas of Juncus marsh, such as those in Carteret County, can exist in a natural condition without producing significant numbers of Aedes, the need to conduct intensive season-long surveys in salt marshes to accurately determine mosquito production is extremely essential. Such surveys would help to locate areas of marsh most suitable for the construction of an impoundment. These areas would contain large, scattered clusters of breeding sites yielding consistently large numbers of Aedes mosquitoes. If the larval surveys show a definite need for mosquito control in a

particular area and an impoundment is decided upon, then it is essential that after its completion, the proper water depth and dike management be undertaken and maintained.

CONCLUSIONS

1. In general, vegetation within the impoundments differed markedly from that of the unimpounded areas. Natural marsh plants were often eliminated and, in some cases replaced by plants more suited to the permanent water environment.
2. Mosquito abundance data for both the unimpounded and impounded study areas show that the impoundments are effective in eliminating larval populations of the important pest species A. sollicitans and A. taeniorhynchus.
3. The environmental conditions within the impoundments can create a suitable habitat for the less bothersome Anopheles and Culex mosquitoes. Their numbers, however, can be kept to a minimum with proper water depth and dike management (see Recommendations).
4. Although impoundments can be effective in controlling Aedes mosquitoes, care must be taken in applying this means of control to only those areas of marsh where it is really necessary (see Discussion and Recommendations). This precaution is especially important when considering the fact that, at present, there is an unfortunate lack of information concerning the environmental impact of impoundments on the estuarine systems adjacent to the marsh.

RECOMMENDATIONS

1. To accomplish the most effective source reduction of salt marsh mosquitoes with the least disturbance to the marsh ecosystem, habitat modification procedures such as impounding, should be attempted only after intensive season-long larval surveys have been made. The survey program should include some or all of the following procedures:

   a. Areas subject to flooding should be delineated and then visited at such intervals as required to locate all specific breeding sites occurring within each area.

   b. Once located, each site should be examined frequently during at least one entire season to determine its full mosquito breeding potential.

   c. The use of impoundments should be considered for only those areas of marsh where a large, scattered cluster of breeding sites yielding consistently large numbers of Aedes mosquitoes exist.

   d. The burden of this initial survey work can be considerably lightened by installing tide gauges at strategic points in the survey areas to determine the frequency of flooding. This information will help to eliminate from serious consideration those sections flooding too frequently to be a serious source of mosquito breeding. Additionally, data from tide gauge readings can be used as a basis for predicting the relative abundance of the mosquito species breeding on the marsh. With such information, it could develop that under certain conditions, control of one or more species present may not be necessary.

   e. Marsh levels along random transects from the tide gauges to high ground should be determined. Combining marsh elevations with tide gauge data makes it possible to estimate the duration and extent of flooding for each breeding site.

f. Assessment of adult mosquito populations by light trap or other means must be carried out on a regular basis in and adjacent to areas under survey. Additionally, biting and/or landing counts should also be regularly taken to assess the nuisance value of the mosquito species present.

2. If survey and larval-pupal monitoring show a definite need for mosquito control in a particular area and an impoundment is decided upon, then it is essential that after its completion, proper management be undertaken and maintained.

Proper management techniques should include the following:

a. The water depth of the impoundment should be at least 12 inches. This will prevent the development of prolific emergent and floating stands of vegetation which produce conditions suitable for the breeding of permanent water mosquitoes. In North Carolina, areas of the impoundment which should be closely checked are those in which J. roemerianus and R. maritima are in close association. (e.g. R. maritima surrounding J. roemerianus).

b. The water depth should also be high enough to cover any highground that was present in the original marsh. These regions usually contain Pinus spp. and Baccharis halimifolia L. (groundsel bush) interspersed with patches of D. spicata and S. patens.

c. The environmental conditions within the impoundment should be maintained in such a way as to encourage the production and activity of top-feeding minnows.

d. The entire top of the dike should be checked periodically for depressions due to erosion from rain and/or muskrat activity. These depressions may become filled with water and produce broods of Aedes

mosquitoes. Rain and impoundment water may also collect more permanently in muskrat holes which open into the impoundment beneath the waterline, and create suitable habitats for mosquitoes such as Culex salinarius. Depressions and muskrat holes found should be filled with soil and leveled off to prevent further accumulation of water.

INTRODUCTION

Five species of mosquitoes are commonly produced on the salt marshes of North Carolina: Aedes taeniorhynchus (Wiedemann), A. sollicitans (Walker), Culex salinarius Coquillett, Anopheles bradleyi King, and An. atropos Dyar and Knab. Only the first two species normally constitute a serious pest problem to man and his domestic animals.

Both Aedes species lay their eggs on drying soil and require at least a few days of continued drying before inundation by tides or rainfall will hatch the eggs. Because of this feature, it has been postulated that impoundment of prolific breeding areas would control these economically important mosquito species by eliminating drying conditions which are required for oviposition.

This means of control was first applied, although based on a different principle, to reduce populations of malaria mosquitoes in Louisiana bayou country (Van Dine, 1922). Heavily vegetated areas of water which produced the undisturbed environments conducive to the breeding of An. quadrimaculatus Say were permanently flooded and the waterline area of the banks enclosing the impoundments was kept free of vegetation. This produced an open water situation which efficiently prevented mosquito breeding and reduced the incidence of malaria.

The bank management techniques used in Louisiana were later adopted in conjunction with water level management programs, to reduce An. quadrimaculatus in the TVA reservoirs (Anonymous, 1947; Christopher et al, 1957).

Later, this method was expanded to include the control of salt marsh Aedes through the elimination of the exposed soil needed for oviposition. As a subsequent outgrowth of this, the concept developed that if properly managed,

an impoundment could be made to serve a dual purpose. First, it would eliminate the breeding of salt marsh Aedes and, if vegetational growth was kept to a minimum, of salt marsh Anopheles and Culex. Second, it would provide an excellent habitat for waterfowl, muskrat and fish production (Darsie and Springer 1957, Provost 1959, Ferrigno 1969, Lake and Murphey 1970, Service 1971).

A careful assessment of the effectiveness of impoundments in eliminating salt marsh Aedes populations has never been made in North Carolina, nor in the adjacent states of Virginia and South Carolina. Such work has been done in New Jersey, Delaware and Florida, and although these states do not have the type marshes characteristic of coastal North Carolina, the results have been, to a certain degree, favorable.

The impoundments in the states where studies were conducted ranged from shallow brackish water impoundments of less than 12 inches in depth, to deep fresh water impoundments of over 12 inches in depth (Lesser 1965). The latter type was constructed in such a manner as to retain precipitation and surface runoff from upland streams and to prevent excessive salt water intrusion. The purpose of this was to maintain open expanses of water several feet in depth to encourage growth of certain pondweeds for duck food (Darsie and Springer 1957).

In all the studies, it was shown that the breeding of salt marsh Aedes was substantially reduced or eliminated. However, the permanent water conditions found in these impoundments did create a suitable environment for the less bothersome Culex and Anopheles species.

C. salinarius was reported as the most commonly collected species in these impoundments. This species was taken in New Jersey from areas consisting of dead Spartina alterniflora Loisel and S. patens and from areas containing Phragmites communis Trinius (Chapman and Ferrigno 1956, Chapman 1959, Franz

1962, 1963, Franz and Ruber 1962, Mangold 1962). In Florida, Clements et al (1964) reported collecting C. salinarius from areas of cattail (Typha) in impoundments flooded both yearlong and seasonally from March through October. In Delaware, this species also continued to thrive in areas of relatively deep water containing Phragmites, cattail and switchgrass (Darsie and Springer 1957), and in areas where emergent vegetation such as S. patens was flooded to depths of 6 inches or less (Catts et al 1963, and Lesser 1965).

Two other species, An. bradleyi and An. quadrimaculatus were also collected in substantial numbers from flooded emergent vegetation in the impoundments. The former species was taken predominantly from areas containing cattail and soft-stem bulrush (Chapman 1959, Florschutz 1959, Tindall 1961, and Clements et al 1964). An. quadrimaculatus was found in largest numbers in sections of the deep, fresh water impoundments which contained predominantly Phragmites, cattail, switchgrass (Panicum) and swampdock (Rumex). Additionally, Uranotaenia sapphirina (Osten Sacken), C. restuans Theobald, Mansonia perturbans (Walker) and Aedes vexans (Meigen) were collected less frequently from these same plant mixtures. The last species was found only after rises in water level resulting from heavy rains (Darsie and Springer, 1957).

From observations made during these impoundment studies, it was concluded that the populations of Anopheles and Culex mosquitoes found in these situations could be substantially reduced or even eliminated by maintaining the proper water levels.

Both Provost (1959) and Catts et al (1963) found that keeping the water between 9 and 12 inches would reduce the number of Anopheles and Culex mosquitoes. In other cases, it was reported that these species could be sufficiently controlled if the water level did not drop more than 10 inches below the maximum water depth of the impoundment (3'8") (Florschutz 1959).

In North Carolina, several impoundments have been constructed within the past 10 years in the hope of reducing Aedes mosquitoes in salt marshes vegetated predominantly with Juncus roemerianus. The following report includes the results and conclusions of a project that was established to evaluate the effects of some of these impoundments on the production of salt marsh mosquitoes.

PROCEDURE

This research project was conducted on irregularly flooded salt marsh areas in Carteret and Pamlico Counties (see fig. 1, p.26). The areas were specifically located at: Smyrna Creek, 1 mile north of Davis in Carteret County and between Florence and Whortonsville in Pamlico County (see fig. 2 and 3, pp. 27 and 28).

The Florence-Whortonsville area included 3 impoundments surrounded by large expanses of adjacent unimpounded salt marsh. Sections of the latter were used as the control. The Smyrna Creek area contained only one impoundment. The Kings Point area was used as its control, since it represented the nearest appropriate tract of natural marsh.

In order to compare the size and species composition of the mosquito populations occurring in the impounded and unimpounded marsh, a standard larval-pupal monitoring procedure was established. Collections were made at the Smyrna Creek impoundment from July 15th to October 31st, 1972; Kings Point from March 1st to September 30th, 1972 and at the Florence-Whortonsville area from April 15th to October 6th, 1973.

The study areas were surveyed on foot for breeding. A representative number of the breeding sites found were selected, numbered and marked with stakes. Additionally, the maximum area of each was determined. These locations are represented by an encircled "x" in the study area drawings reproduced in figures 4, 5, 6 on pp. 29, 30 and 31. For monitoring purposes, each site was visited 1 to 3 times a week. At each visit the water depth was determined and for most visits the information necessary for the calculation of a breeding index was collected. These data served as a basis for determining frequency of standing water, water level fluctuation and the influence of these factors on size and species composition of mosquito populations in the study areas.

Additional information on the quantity of standing water on the marshes was obtained from a Leupold-Stevens type F tide gauge recorder, set up in each research area. The data collected from the tide gauge recorders also helped to determine the flooding frequency of the unimpounded sites.

Salinity samples were taken periodically at each impoundment. A refractometer was used to determine parts/thousand (0/00) of salt. These data were used to determine and compare the degree of fluctuation in the salinity of each impoundment and whether or not these changes had any effect on mosquito breeding.

The study area at the Smyrna Creek impoundment consisted of approximately ten acres of flooded Juncus marsh (see fig. 4, p. 29). Twelve sites which represented various plant associations and water depths were marked and visited. The control area at Kings Point contained 21 sites occurring in an area of 50 acres. Twenty of these sites occurred along 2 transects which began at the same point 500 feet from Route 70 and diverged across the marsh to Core Sound. One transect ended at a tide gauge and the other at a berm area. The one remaining site, number 21, was located in brushy highground near the highway (see fig. 5, p. 30). The transect method was used as a convenient sampling procedure to locate sites representing various flooding frequencies.

Impoundment No. 1 at the Florence-Whortonsville area, completed in January 1965 and flooded the following month, was 70 acres in size. Ten potential sites, all near the perimeter of the impoundment, were selected, marked and numbered. No sites were selected toward the center of the impoundment, since in this section deep, open water prevailed, precluding the existence of any mosquito breeding (see fig. 6, p. 31).

Impoundment No. 2, in the same area was completed and flooded in July 1965 and consisted of 638 acres divided by means of dikes into 3 sections, each approximately 200 acres in area. Twelve potential breeding sites, all situated near the perimeter of the impoundment, were marked and numbered. Additionally,

a transect was set up through a large, thick stand of Juncus roemerianus and Ruppia maritima located in the northernmost section.

Impoundment No. 3, completed in October 1965 and flooded the following month, consisted of 123 acres. Ten sites near the dikes were selected (see fig. 6, p. 31). As in Impoundment No. 1, no sites were selected toward the middle, since, here too, there was deeper, open water. The control area consisted of 18 unimpounded sites adjacent to these 3 impoundments (see fig. 6, p. 31).

Larval-pupal numbers were determined at the study sites by means of the sampling procedure reported by Belkin (1954). Representative samples of the larvae and pupae collected at each site during this sampling procedure were brought into the laboratory. The specimens were killed in boiling water and preserved in 80% alcohol for subsequent identification.

To further measure the mosquito populations, standard New Jersey light traps were operated and biting catches were made near the study areas.

In Carteret County, one light trap was operated at Davis, and in Pamlico County, 3 light traps were in operation, one each at Oriental, Bayboro, and Florence (see fig. 2 and 3, pp. 27 and 28). Each trap was on from 7 p.m. to 6 a.m. and the collections were picked up at least 3 times weekly.

Biting catches were taken once or twice a week at Davis from June 1st to September 30, 1972 and at Oriental from June 7th to October 1, 1973. The adults were collected off the arms and legs of one of the authors by means of an aspirator tube. Ten minute catches were made every half-hour from sunset to at least 10 p.m..

The temperature and rainfall data needed for this research was obtained from Climatological Data published by the U.S. Department of Commerce. Stations at Cedar Island in Carteret County and at New Bern in Pamlico County were used as representative of each research area.

A survey of vegetation was made at each breeding site in an attempt to

correlate the plant cover with the numbers and kinds of mosquitoes present and to determine any vegetational differences between unimpounded and impounded sites. This was done by estimating the number of square feet occupied by each plant species in a 100 square foot plot at the site. In the case of mixed stands, 10 samples were selected at random from each stand and the ratio of the mean number of stems of each plant species to the total number in the 10 samples, was determined.

The following is an explanation of some of the values given in the text, tables and graphs.

Frequency of flooding/month at tide gauge.

This was determined by dividing the total number of floodings for an area by the number of months the tide gauge was in operation.

Frequency of flooding/month at each site.

Since the floodings at the tide gauge did not necessarily mean that sites located at various distances from the gauge were also flooded, a separate determination of the frequency of flooding/month was obtained for each site. A surveyor's transit was used to determine the site's height in relation to the tide gauge. The number of times the tide reached higher than the height of the site was divided by the number of months the tide gauge was in operation.

Frequency of standing water/site (FOSW).

Determined by dividing the number of days when water was present at each site by the number of days during the research interval.

Mean frequency of standing water/area.

Determined by totalling up all frequency of standing water values for the sites of an area and dividing by the number of sites in the area.

Mean number of mosquitoes taken per light trap night.

Determined by dividing the total number of specimens taken/week by the

number of nights the light trap was in operation that week.

Mean number of mosquitoes taken biting per 10 minute interval.

Determined by dividing the total number of specimens taken each night in biting counts by the number of 10 minute intervals in each collecting period.

Breeding index.

This value was determined by the method and formula developed by Belkin (1954), where Breeding Index (B.I.) = $\frac{SA \times PD \times TLP}{ND \times ND \times 10}$

SA = Surface area of body of water serving as effective breeding site in square feet.

PD = Positive dips obtained (those dips in which mosquito larvae and pupae are found).

TLP = Total number of larvae and pupae obtained.

ND = Total number of dips taken, disregarding all negative dips prior to the first positive dip.

RESULTS

Data on the frequency, duration and extent of flooding of the unimpounded sections for both counties are summarized in Text Tables 1 and 2 on pp. 46 and 47, and detailed in Appendix Tables 1 and 2 on pp. 55 and 56.

The most notable difference between these two unimpounded sections was that of surface water availability for mosquito breeding. The mean flooding frequencies for the sites ranged from 8 floodings/month at the Florence-Whortonsville area to 21 floodings/month at Kings Point. This produced a much lower standing water frequency for the former area (46%) than for the latter (80%). This difference in water availability produced noticeable differences in the species composition of both the vegetation and the mosquito populations in each county. The number of mosquitoes present was also affected.

The vegetational summaries for the unimpounded areas are found in Text Tables 3 and 5 on pp. 48 and 49, and detailed in Appendix Tables 3 and 5 on pp. 57 and 59. In Carteret County, the vegetation of the sites at Kings Point consisted predominantly of J. roemerianus, usually matted down to form open areas, with smaller amounts of D. spicata, S. patens and Cladium jamaicense Crantz. The unimpounded sites in Pamlico County contained a much larger percentage of D. spicata than in Carteret County. This species was often in combination with S. patens and surrounded by J. roemerianus.

Data on the abundance and species composition of mosquito populations found in the unimpounded areas of both counties are found in Text Tables 7 and 9, pp. 50 and 52, and detailed in Appendix Tables 6 and 8, pp. 60 and 63. The mosquito populations found occurring in both unimpounded areas consisted principally of A. sollicitans, A. taeniorhynchus and An. bradleyi. Additionally, small numbers of An. atropos and C. salinarius were taken from time to time. Aedes atlanticus and Psorophora confinnis were found breeding in wooded sites around the marsh.

A much smaller number of larvae were taken from the sites at Kings Point (total number 1605, 2.4 larvae/positive dip) than from those in Pamlico County (total number 36,891, 42.3 larvae/positive dip). Of the larvae collected from the former area, 65% were Anopheles and Culex species and 35% were Aedes and Psorophora species. In Pamlico County 96.5% of the total number of specimens collected were A. sollicitans and A. taeniorhynchus, and almost all of the remaining percentage was An. bradleyi. In both counties, the Anopheles and Culex species were distributed more or less evenly throughout the marsh, whereas, the Aedes and Psorophora species were more often encountered in sites with comparatively lower flooding frequencies and deeper depressions (high slope index values).

Despite the above differences in vegetational characteristics and mosquito abundance, the effects of the impoundments on these types of marshes were generally the same.

In both counties, the changes in vegetation were quite apparent. Much of the Juncus found in the Smyrna Creek impoundment was either dead, dying or, as in a few isolated locations, replaced by Typha (cattail). All of the areas of D. spicata and S. patens were eliminated, surviving only near the perimeter of the impoundment. In the Florence-Whortonsville impoundments, the two dominant plant species D. spicata and S. patens were also eliminated. They were replaced by extensive areas of introduced R. maritima. In some cases, as in Impoundment No. 2, large stands of J. roemerianus remained and thrived (see fig. 6, p. 31).

Mosquito populations in all the impounded areas were much reduced (see Text Tables 8 and 10, pp. 51 and 52, and Appendix Tables 7 and 9, pp. 62 and 65).

At Smyrna Creek, the total number of specimens taken was 178 (5.71 larvae/positive dip) all of which were Culex and Anopheles species. C. salinarius

was the most commonly collected species in this impoundment, accounting for 97% of the total number of larvae taken from the study area. This species was found exclusively at Site No. 1, located about 16 feet from the edge of the dike near the southern portion of the impoundment (see fig. 4, p. 29). This 150 square foot section consisted of thick mats of D. spicata along with traces of S. patens. The average water depth of this site was 10.8" with a seasonal fluctuation of 8" - 13". The mean salinity of the water was 3 0/00 with a range of 2-4 0/00. The thickest mats of vegetation and the highest number of mosquitoes taken occurred when the water depth was approximately 8" or lower. Very few larvae were collected when the water depth was greater than 12".

Aside from Site No. 1, mosquito breeding at the other sites in this impoundment was extremely rare. The remaining 3% of the total number of specimens taken, all of which were Anopheles, were found in Sites 2, 5, 6 and 11 (see fig. 4, p. 29). The vegetation in these sites consisted primarily of large, thick stands of dead J. roemerianus. The salinity at these sites ranged from 2.0-2.5 0/00.

In Pamlico County, mosquito larvae were found only within the northernmost section of Impoundment No. 2 (see fig. 6, p. 31), and in one depression and 5 muskrat holes on the dikes of Impoundments Nos. 1 and 2. No larvae were found within Impoundments 1 and 3.

In Impoundment No. 2, three larvae were collected from perimeter sites 1 and 2. Of these three larvae, 2 were An. bradleyi and one was C. salinarius. The remainder taken from this section (104; 1.31 larvae/positive dip) were found along the transect (see fig. 6, p. 31). Of this number, 94% were An. bradleyi, 3% An. quadrimaculatus and 3% C. salinarius. The vegetation of these sites consisted of large clumps of J. roemerianus in combination with thick mats of R. maritima. The number of specimens taken was highest during

the weeks of July and August when both the water depth was lowest (below 12 inches) and the Ruppia surrounding the Juncus was thickest (see Text Table 11, p. 53). In the sites where no larvae were collected, very few Ruppia-Juncus mixtures were found. These sites either had no vegetation or were vegetated only with J. roemerianus or R. maritima in various thicknesses.

At the top of the dike of Impoundment No. 1, one depression, 10 square feet in surface area, 1 inch in depth and containing 100% D. spicata, yielded a brood of Aedes mosquitoes during the week of May 3rd. The breeding index was 6.0 and the total number of larvae collected was 60. C. salinarius was collected from May 12-23rd from impoundment water contained in 5 muskrat holes, one found on the dike of Impoundment No. 1, and 4 found on the dike of Impoundment No. 2. A total of 1120 larvae were taken from the muskrat holes.

The mean salinity for all 3 impoundments at the Florence-Whortonsville area ranged from 7.8 0/00 at Impoundment No. 2 to 10.8 0/00 at Impoundment No. 3.

Additional information on the mosquito populations at the study areas, obtained from light trap and biting count data, is found in figures 7-19, pp. 32 to 44 and Appendix Tables 12-23, pp. 70 to 85.

According to these data, the Aedes and Psorophora species were the most commonly collected mosquitoes at the Davis light trap in Carteret County. Here, they ranged in abundance from 1123 taken in June to over 2000 collected in August (see figs. 7 and 8 , pp. 32 and 33, and Appendix Tables 14 and 15, pp. 72 and 74).

The numbers of An. bradleyi and An. atropos taken at the Davis light trap were somewhat lower, ranging from 637 in June to 970 in September. The numbers collected during biting counts was highest in June and August when 65 and 100 adults were taken respectively.

At Bayboro in Pamlico County, Culex and A. taeniorhynchus were the most commonly collected mosquitoes in the light trap (see fig. 12, p. 37 and

Appendix Tables 16 and 17, pp. 75 and 76). A. taeniorhynchus was also the most commonly collected species in the light trap and biting counts at Oriental and, in addition to An. bradleyi, the most commonly collected species in the Florence light trap (see figs. 14 and 15, pp. 39 and 40, and Appendix Tables 18-23, pp. 77 to 85).. A. sollicitans was collected in substantial numbers only at the Oriental light trap. The interval of highest adult abundance for all the above species taken in Pamlico County was from the latter part of June through the early part of October. During this time, the highest peaks of abundance ranged from 99 for Culex in June at Bayboro to over 1400 for An. bradleyi in October at Florence.

DISCUSSION

The influence of these impoundments on the mosquito populations in salt marshes varying in physical and vegetational characteristics were similar. In both counties, mosquito populations were greatly reduced. This reduction could be maintained as long as the water depths of the impoundments were great enough, usually 12" or above, to help cover mixtures of emergent vegetation. At levels below 12 inches, the combinations of the various plant species were usually at their highest density (e.g. R. maritima surrounding J. roemerianus and mixtures of D. spicata and S. patens near perimeter of dike) and served as suitable environments for populations of permanent water mosquitoes such as An. bradleyi and C. salinarius. Apparently, the thick vegetation offered a good sanctuary for mosquito larvae, helping to protect them from predators and undue water disturbance. The undisturbed nature of these areas may also help to facilitate egg laying and pupal emergence of adult Culex and Anopheles.

The salinity data recorded during this study has shown the Smyrna Creek Impoundment to be fresher than the impoundments studied in Pamlico County. The differences in salinity, however, did not seem to significantly affect the mosquito populations present.

Although the effectiveness of these impoundments in reducing mosquito populations has been demonstrated, a question has arisen as to whether the floodings of certain sections of the study areas was necessary.

According to the data on abundance and species composition of mosquito populations collected from the study areas, very low numbers of mosquitoes were taken from the Kings Point marsh. Both Kings Point and the marsh adjacent to the Smyrna Creek impoundment have very similar flooding conditions. These conditions have been shown in a prior study (LaSalle and Knight 1972) to preclude

the existence of consistently heavy mosquito breeding, especially that of Aedes. It is possible, then, that the permanent flooding of certain sections of the Smyrna Creek marsh could have been bypassed.

The need for the impoundments studied in Pamlico County however, was probably greater, since, in many cases, the marsh conditions surrounding them were more suitable for the production of large numbers of Aedes mosquitoes.

Data on adult mosquito activity from light traps and biting counts in both counties have shown that peak numbers of mosquitoes were highest after periods of major flood tides and prolonged heavy rains. During these periods many areas of high marsh and adjacent woods, usually dry during periods of normal flood tides and drought, can become flooded and produce large numbers of Aedes larvae. It is in or near these areas where permanent control techniques such as impoundments should be considered. In order to locate marsh areas yielding consistently high numbers of mosquito larvae throughout the entire breeding season, it would be necessary to develop a county-wide systematic sampling procedure.

Marsh areas of the type found at Kings Point only occassionally produce annoyingly large broods of Aedes mosquitoes. In such cases, serious consideration should be given to the use of temporary control measures in place of those requiring extensive alterations of the marsh ecosystem.

REFERENCES CITED

Anonymous, 1947. Malarial control on impounded water. U. S. Government Printing Office, Washington, D. C., 422 pages.

Catts, E. P. et al, 1963. Wildlife usage and mosquito production on impounded tidal marshes in Delaware, 1956-1962. Transactions of the Twenty-Eighth North American Wildlife and Natural Resources Conference pp. 125-132.

Chapman, H. C., 1959. Studies of mosquitoes breeding in natural and impounded salt marsh areas in New Jersey. PhD thesis, Department of Entomology, Rutgers State University, New Brunswick, New Jersey.

Chapman, H. C. and F. Ferrigno, 1956. A three-year study of mosquito breeding in natural and impounded salt-marsh areas in New Jersey. Proceedings of the Forty-Third Annual Meeting of the New Jersey Mosquito Extermination Association, pp. 48-64.

Christopher, G. S. and N. W. Bowden, 1957. Mosquito control in reservoirs by water level management. Mosquito News 17(4): 273-277.

Clements, B. W., Jr. and A. J. Rodgers, 1964. Studies of impounding for the control of salt marsh mosquitoes in Florida, 1958-1963. Proceedings of the Twentieth Annual Meeting of the American Mosquito Control Association 24(3): 265-276

Darsie, R. F., Jr. and P. F. Springer, 1957. Three year investigation of mosquito breeding in natural and impounded tidal marshes in Delaware. University of Delaware Agricultural Experiment Station, Bulletin No. 320, 65 pages.

Ferrigno, F., 1969. Ecological approach for improved management of coastal meadowlands. Proceedings of the Fifty-Sixth Annual Meeting of the New Jersey Mosquito Extermination Association, pp. 188-202.

Florschutz, O., Jr., 1959. Mosquito production and wildlife usage in impounded, ditched and unditched tidal marshes at Assawoman Wild-Life Area, Delaware, 1957-1958. Proceedings at the Forty-Sixth Annual Meeting of the New Jersey Extermination Association, pp. 103-111.

Franz, D. R., 1962. Ecological aspect of New Jersey salt marsh impoundments with references to mosquito larval production, distribution and control. M.S. thesis, Department of Entomology, Rutgers State University, New Brunswick, New Jersey, 110 pages.

_____, 1963. Production and distribution of mosquito larvae on some New Jersey salt marsh impoundments. Proceedings of the Fiftieth Annual Meeting of the New Jersey mosquito Extermination Association, pp. 279-285.

Franz, D R , and E. Ruber, 1962. Some effects of salt marsh impoundments on micro-crustacean and mosquito productivity. Proceedings of the Forty-Ninth Annual Meeting of the New Jersey Mosquito Extermination Association, pp. 126-136.

Lake, R. W. and F. J. Murphey, 1970. High and low level impoundments for mosquito control in Delaware. Proceedings of the S. E. Conference on Mosquito Suppression and Wildlife Management, pp. 10-13.

Lesser, F. H., 1965. Some environmental considerations of impounded tidal marshes on mosquito and water bird prevalence, Little Creek Wildlife Area, Delaware. M.S. thesis, University of Delaware, 73 pages.

Mangold, R. E., 1962. The role of low level dike salt impoundments in mosquito control and wildlife utilization. Proceedings of the Forty-Ninth Annual Meeting of the New Jersey Mosquito Extermination Association, pp. 117-120.

Provost, M. W., 1959. Impounding salt marshes for mosquito control and its effects on bird life. The Florida Naturalist 32(4).

Service, M. W., 1971. Conservation and the control of biting flies in temperate regions. Biological Conservation 3(2): 113-122.

Tindall, E. E., 1961. A two-year study of mosquito breeding and wildlife usage in the Little Creek impounded salt marsh, Little Creek Wildlife Area, Delaware, 1959-1960. Proceedings of the Forty-Eighth Annual Meeting of the New Jersey Mosquito Extermination Association, pp. 100-105.

Van Dine, D. L., 1922. Impounding water in a bayou to control breeding of malaria mosquitoes. U. S. Government Printing Office, Washington, D. C., USDA Bulletin No. 1098, 22 pages.

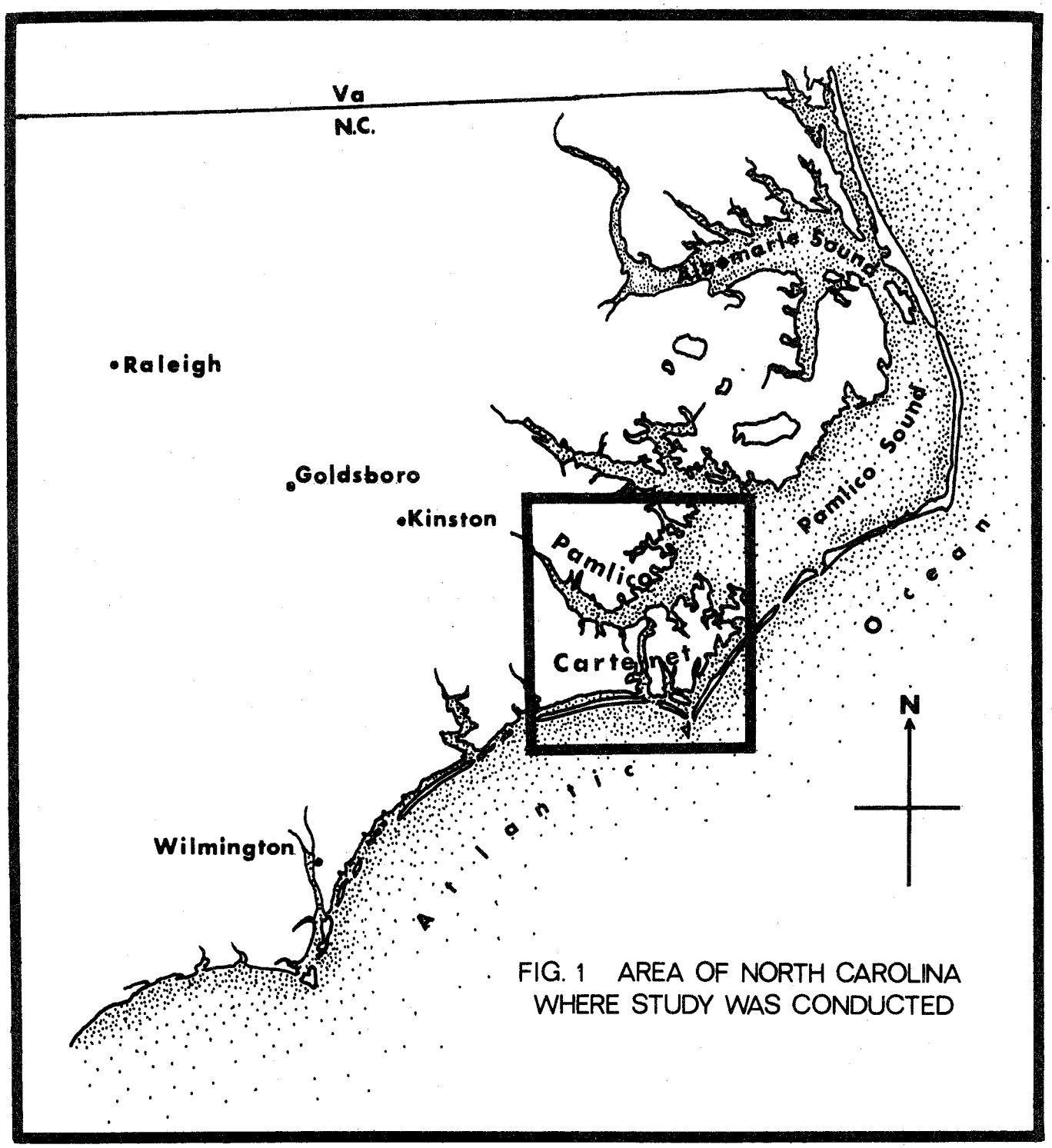


FIG. 1 AREA OF NORTH CAROLINA WHERE STUDY WAS CONDUCTED

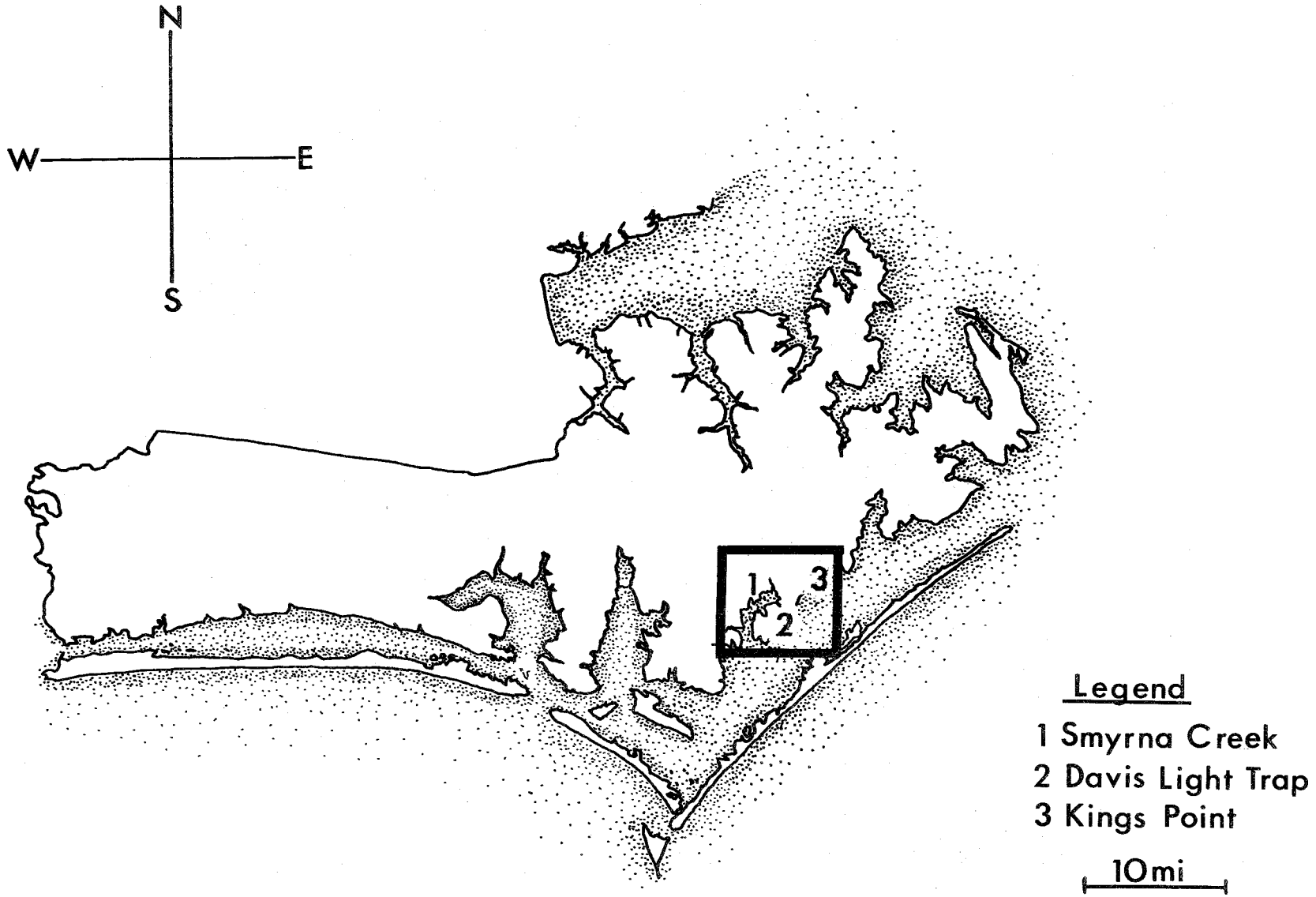


Fig. 2 Carteret Co. Research Area

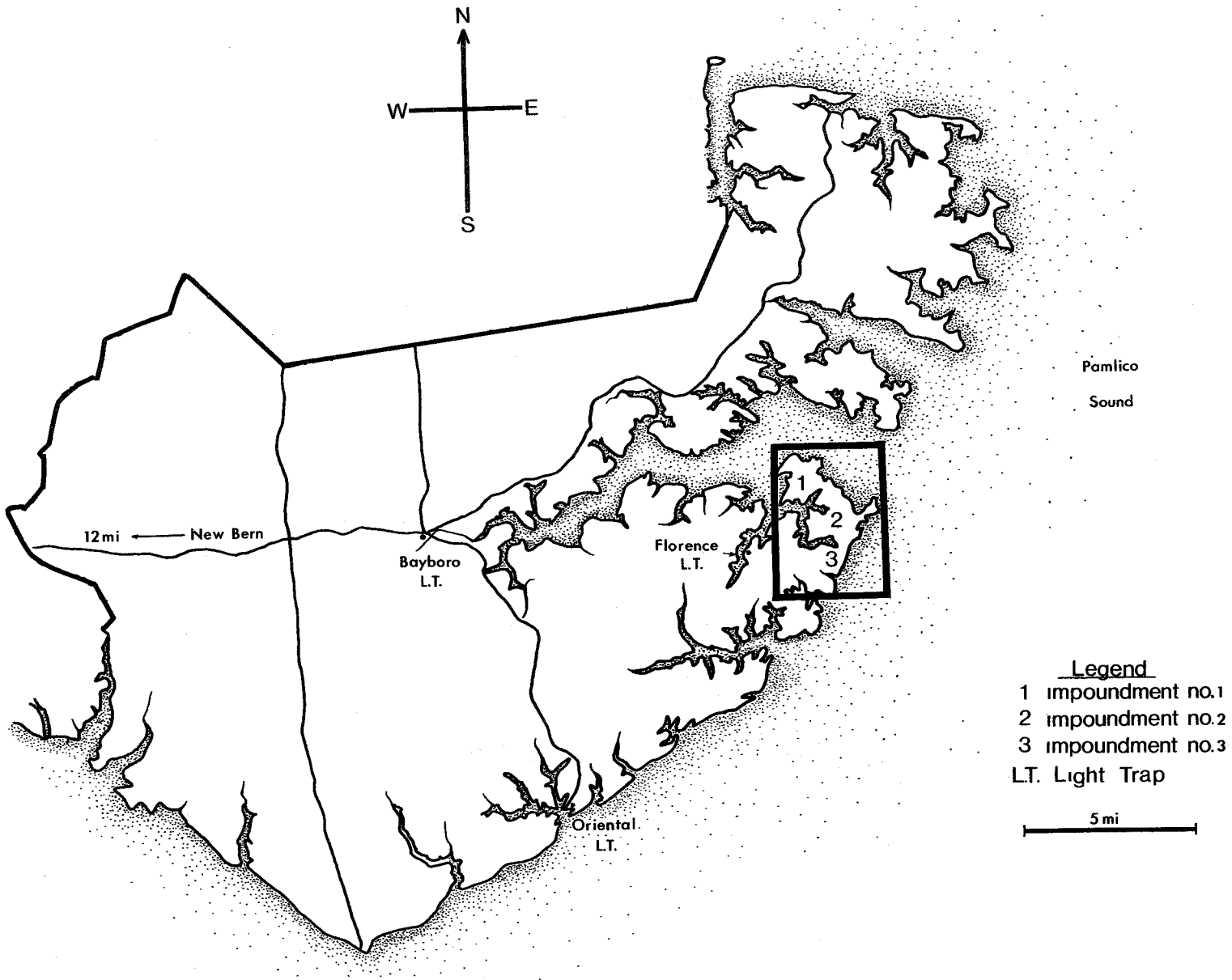
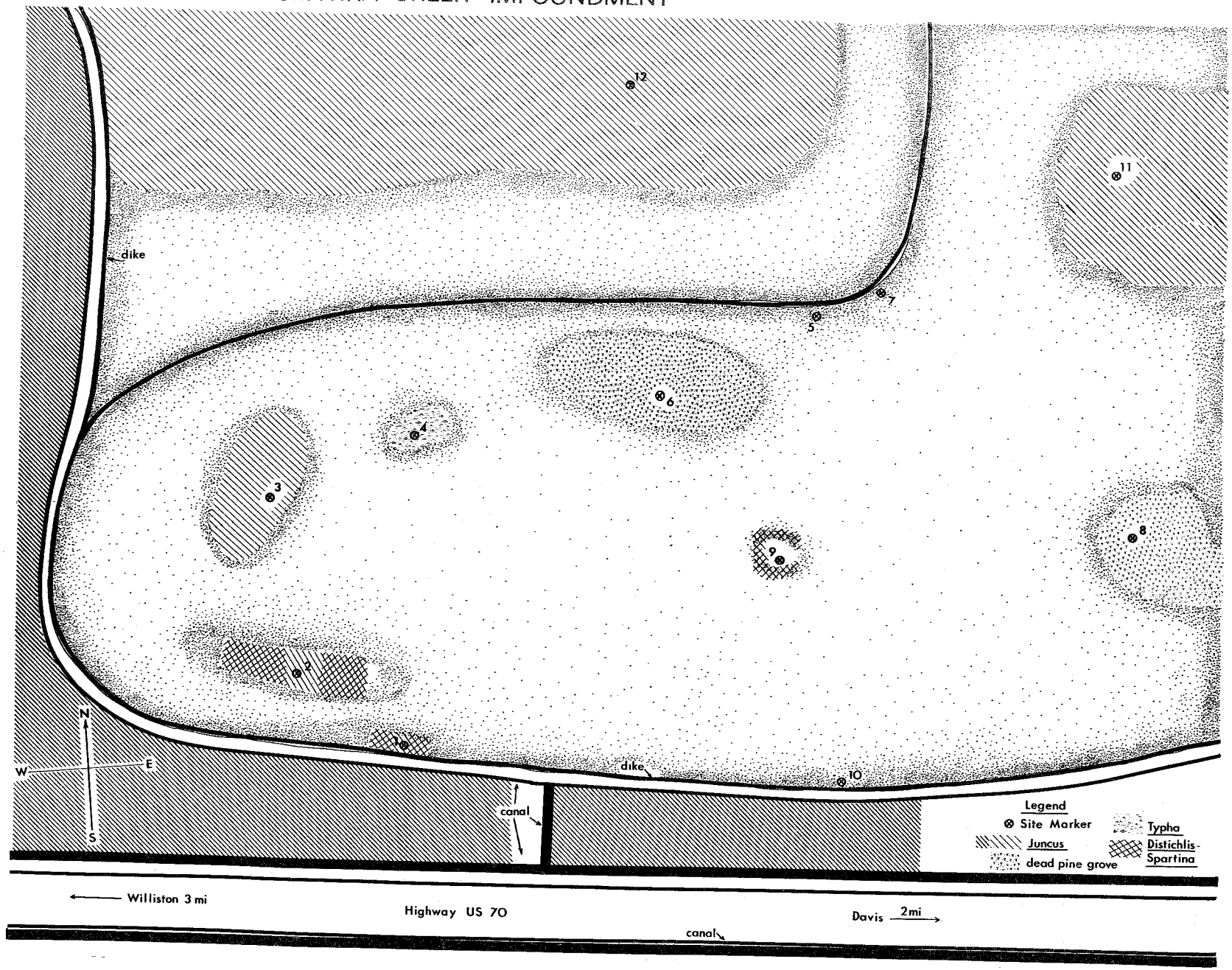


FIG. 3 PAMLICO CO. RESEARCH AREA

FIG. 4 SMYRNA CREEK IMPOUNDMENT



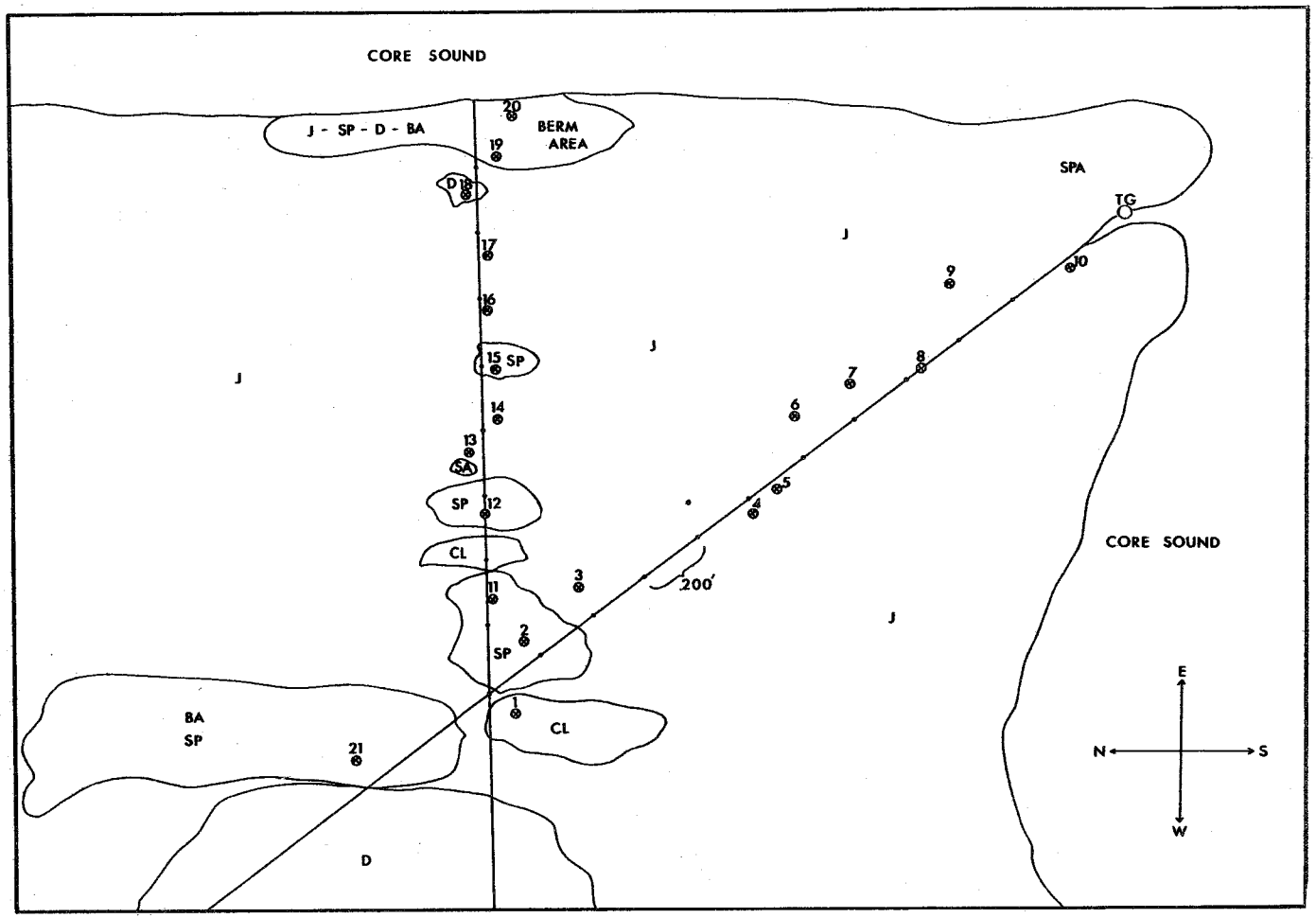


FIG. 5 KING'S POINT STUDY AREA
1972

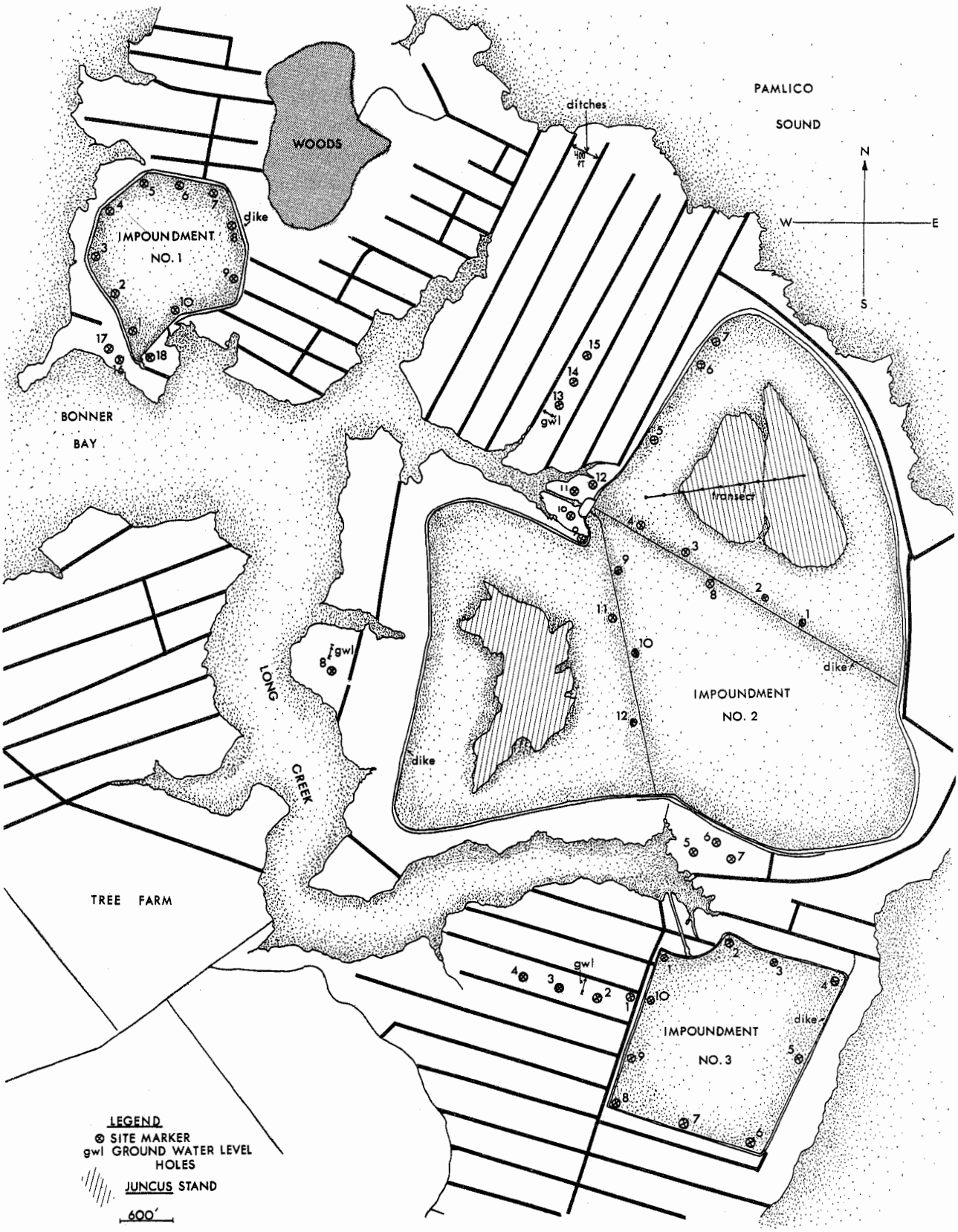


FIG. 6 FLORENCE-WHORTONSVILLE IMPOUNDMENTS

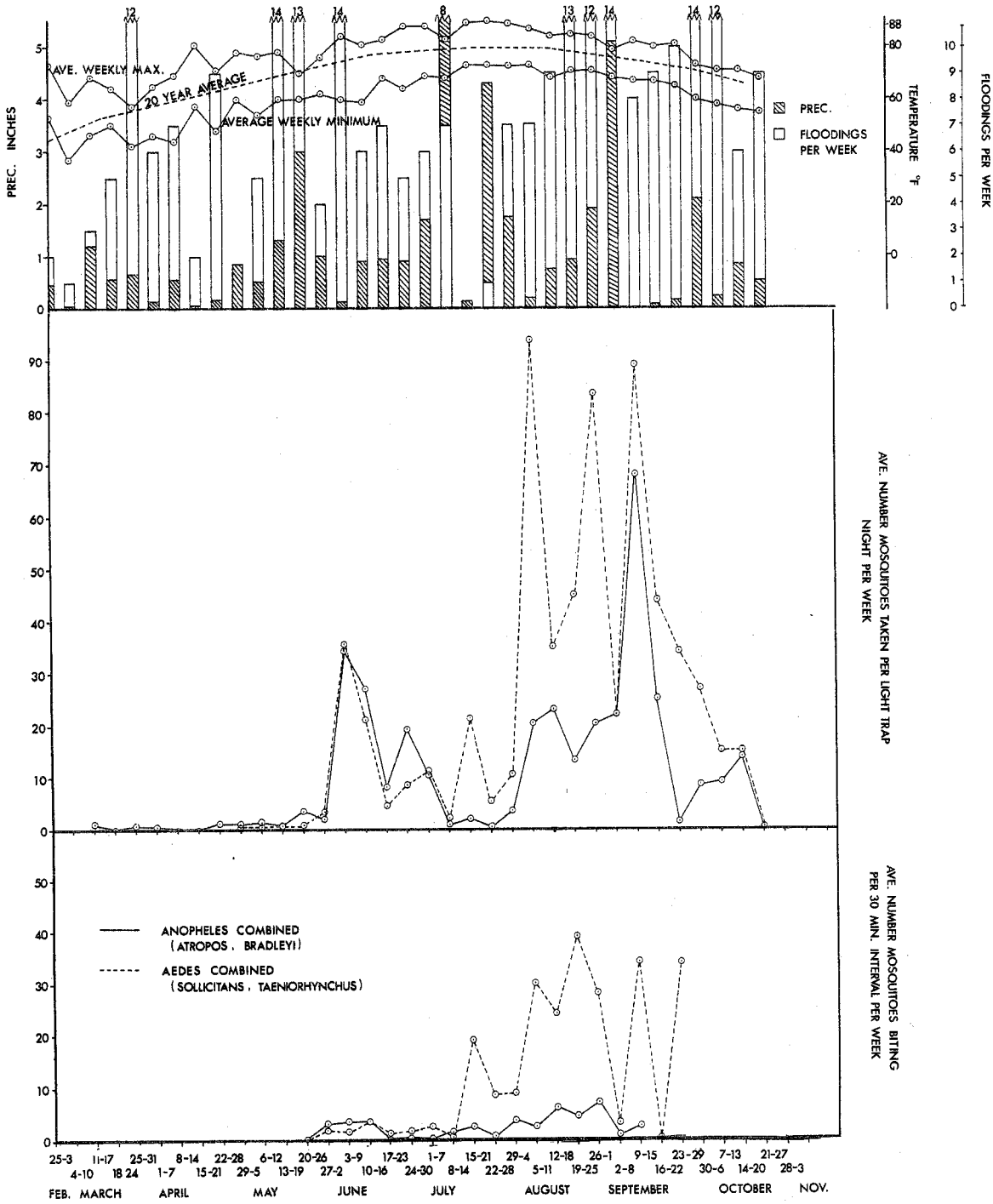


FIG. 7 ACCUMULATIVE DATA FOR THE INTERVAL MAR. 1st-OCT. 31, 1972
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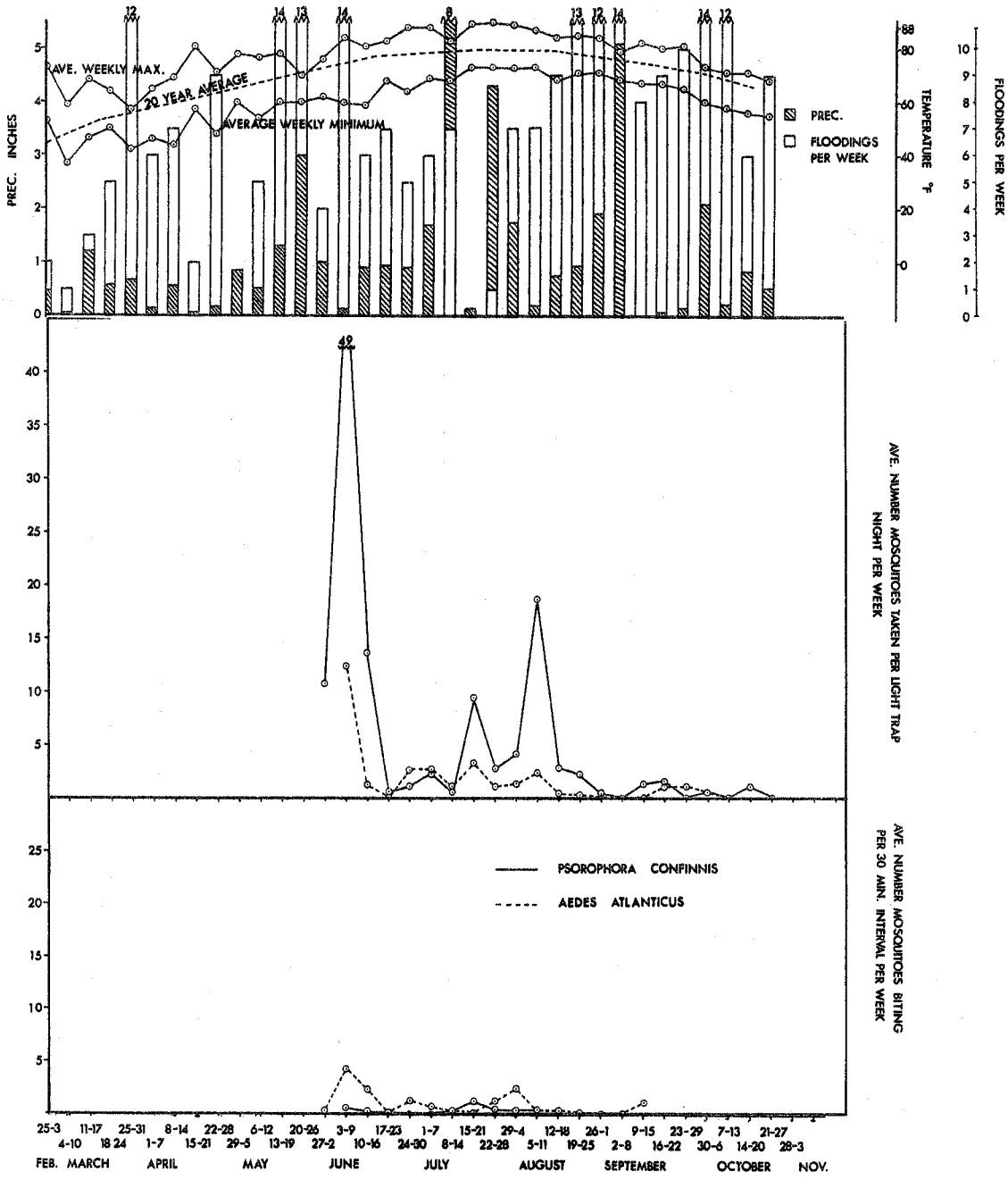

FIG. 8 ACCUMULATIVE DATA FOR THE INTERVAL MAR. 1st-OCT. 31, 1972 DAVIS, N. C.

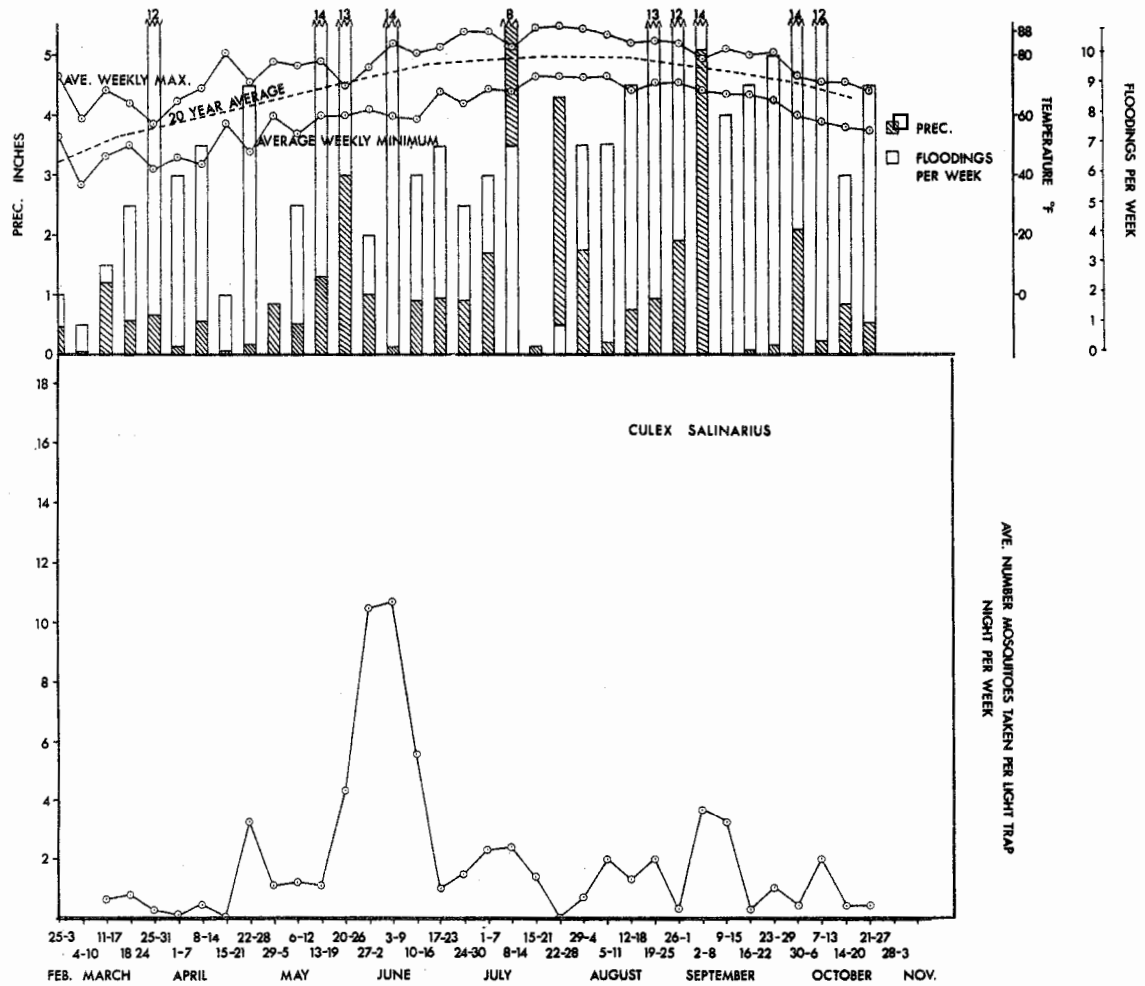

FIG. 9 ACCUMULATIVE DATA FOR THE INTERVAL MAR. 1st-OCT. 31, 1972
DAVIS, N. C.

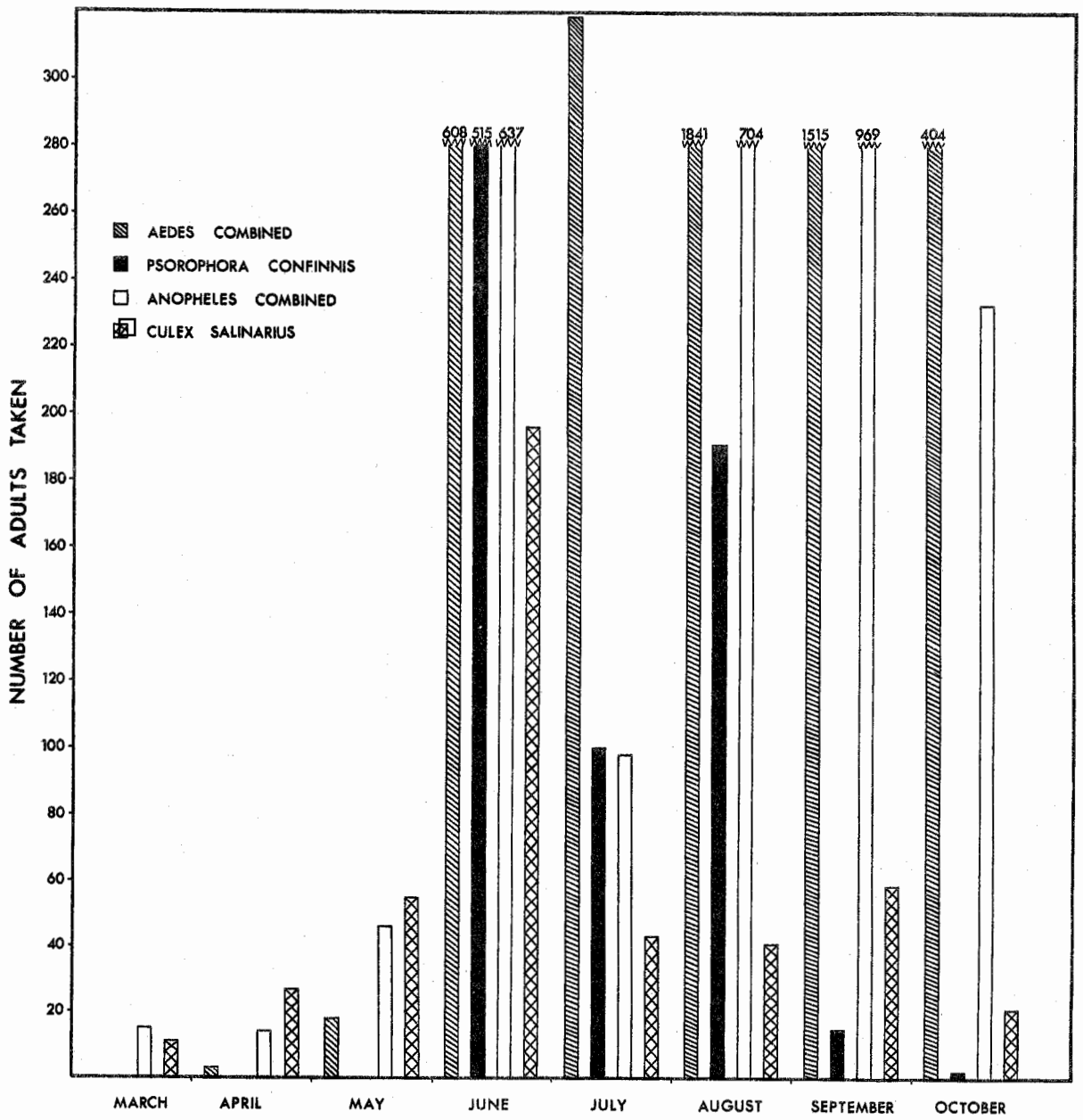

FIG. 10 TOTAL NUMBER OF ADULT MOSQUITOES TAKEN PER MONTH AT THE DAVIS LIGHT TRAP (1972)

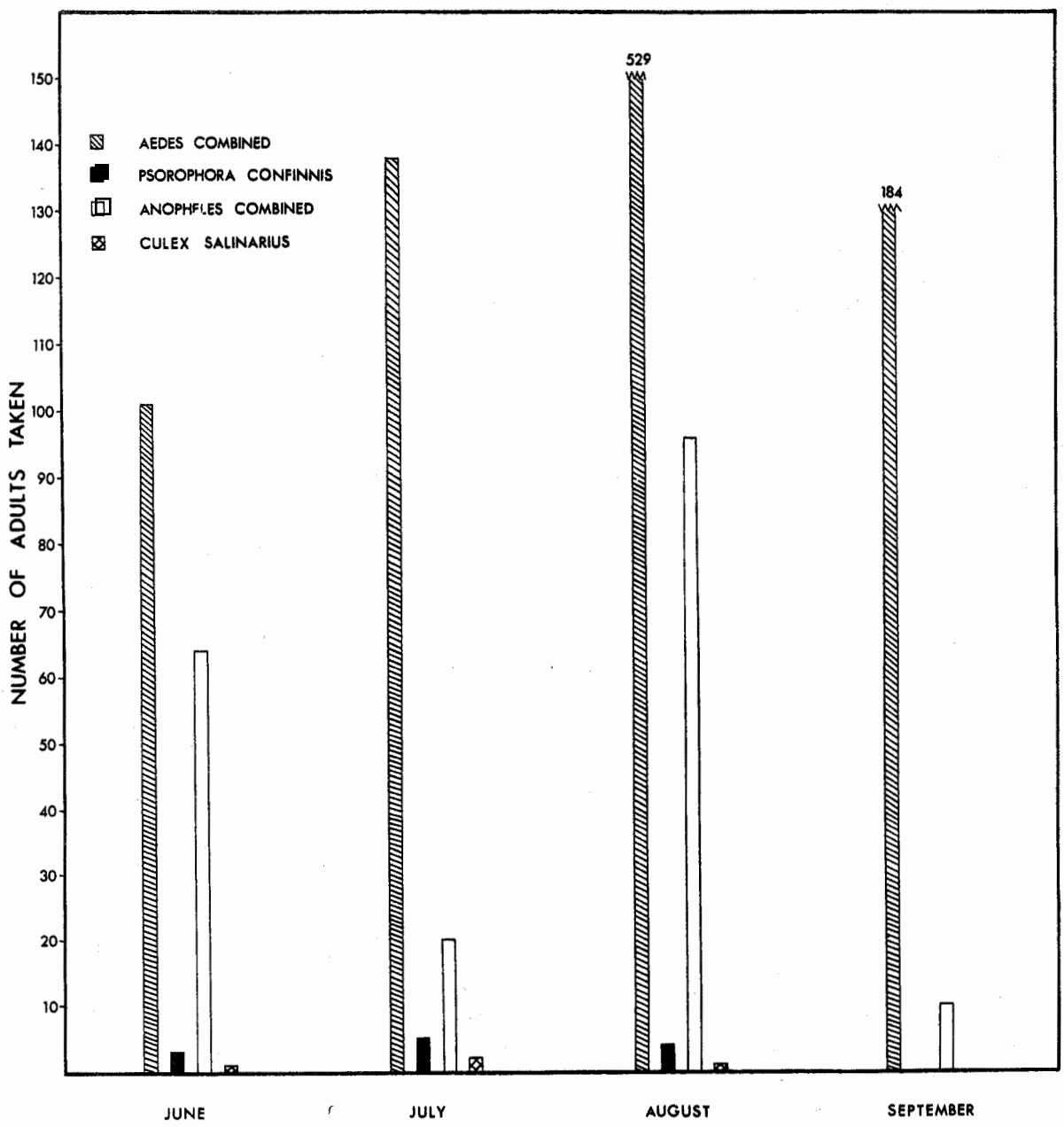

FIG. 11 TOTAL NUMBER OF ADULT MOSQUITOES TAKEN PER MONTH DURING BITING COUNTS AT DAVIS (1972)

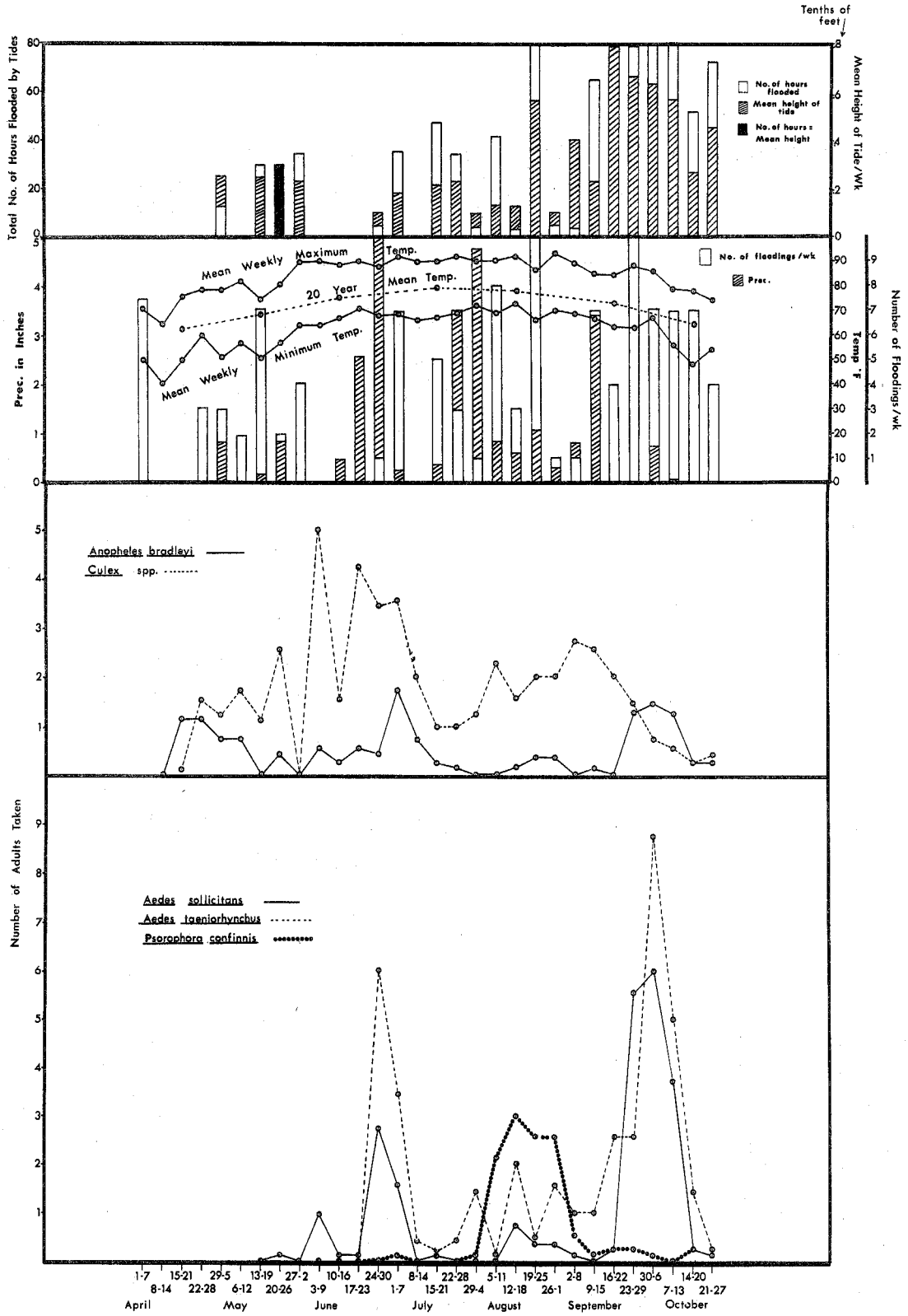

FIG. 12 Mean Number of Adults Taken per Light Trap Night per Week at the Bayboro Light Trap

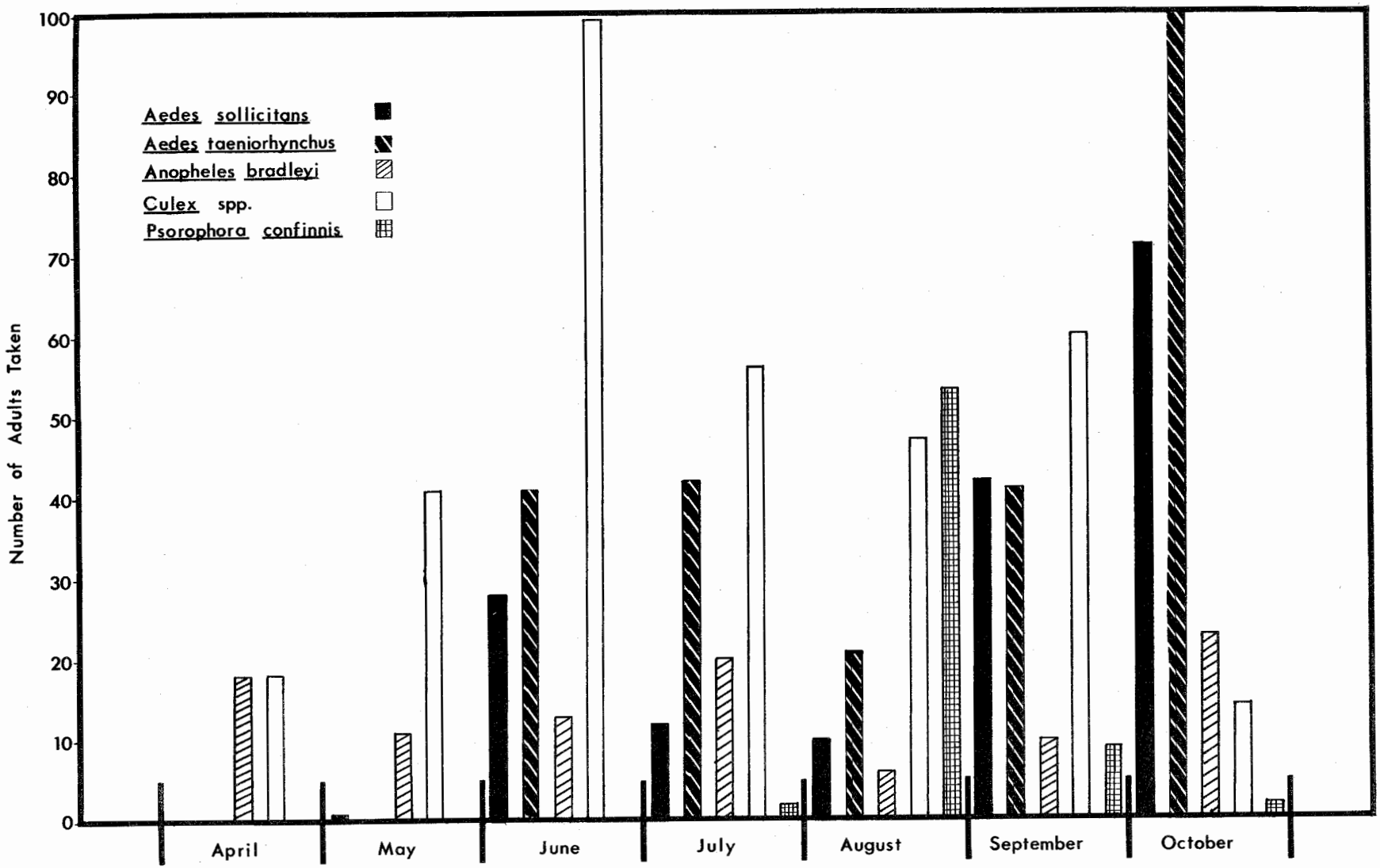

FIG. 13 Total Number of Adults Taken per Month at the Bayboro Light trap

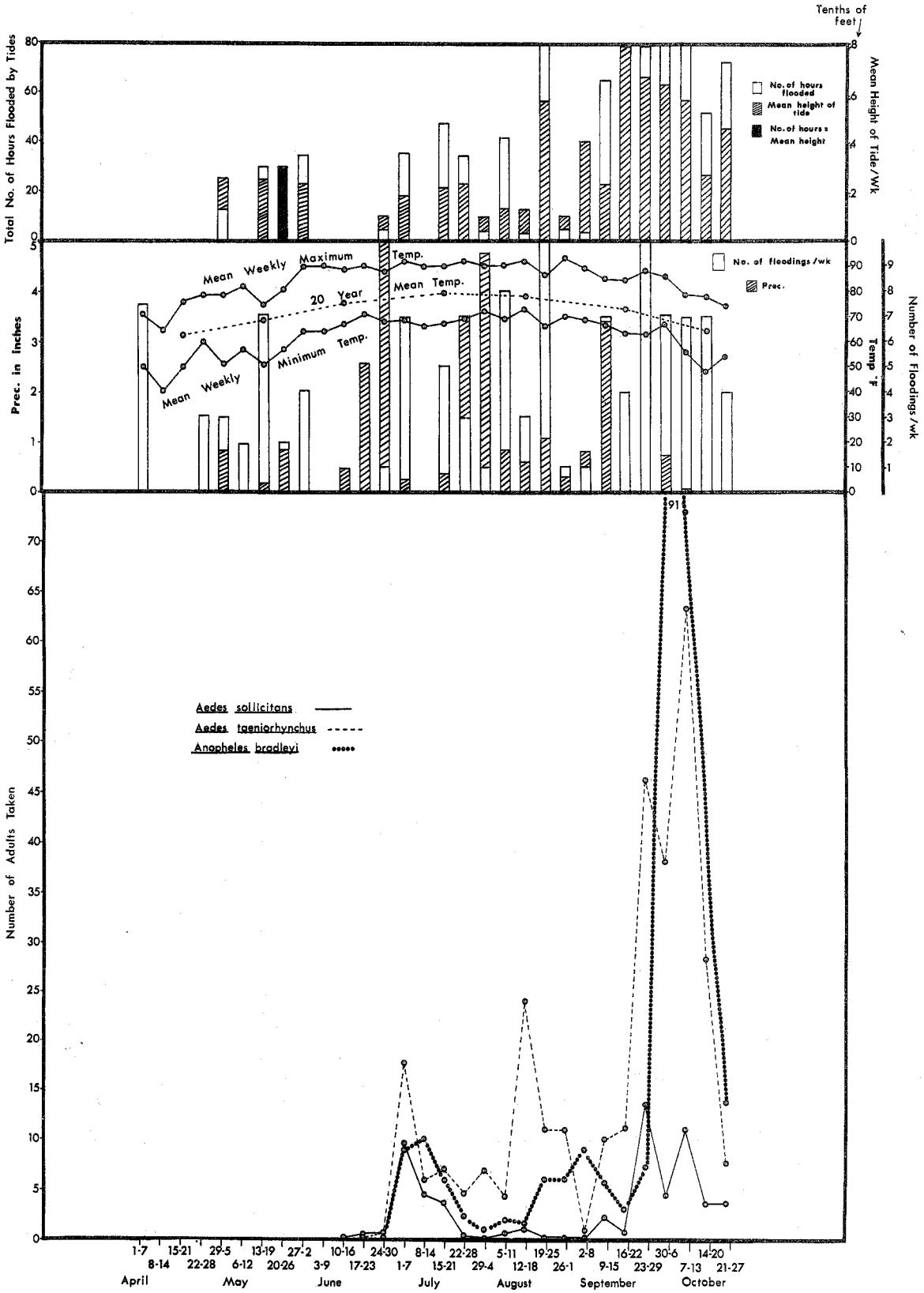

FIG. 14 Mean Number of Adults Taken per Light Trap Night per Week at the Florence Light Trap

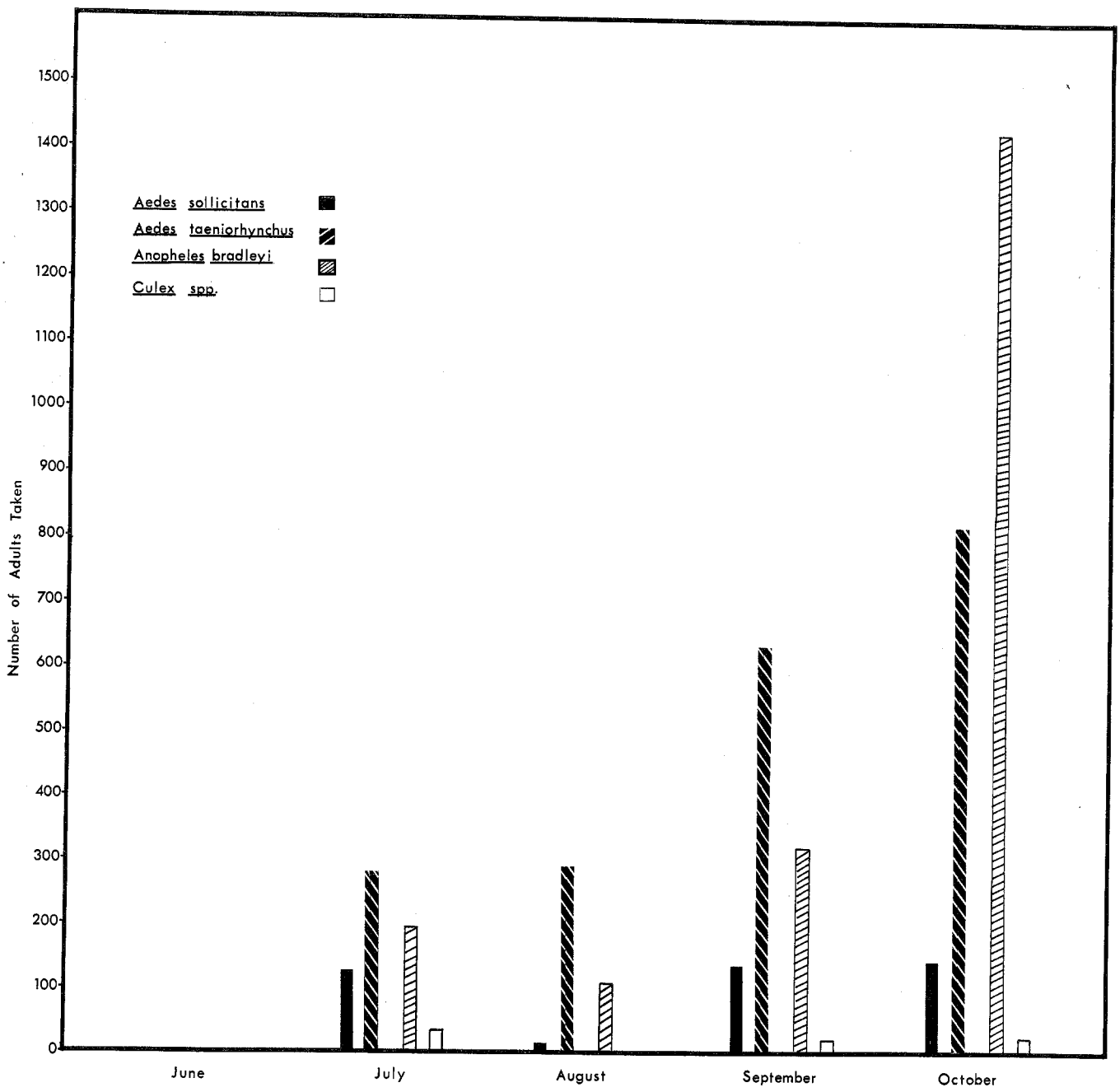

FIG. 15 Total Number of Adults Taken per Month at the Florence Light trap

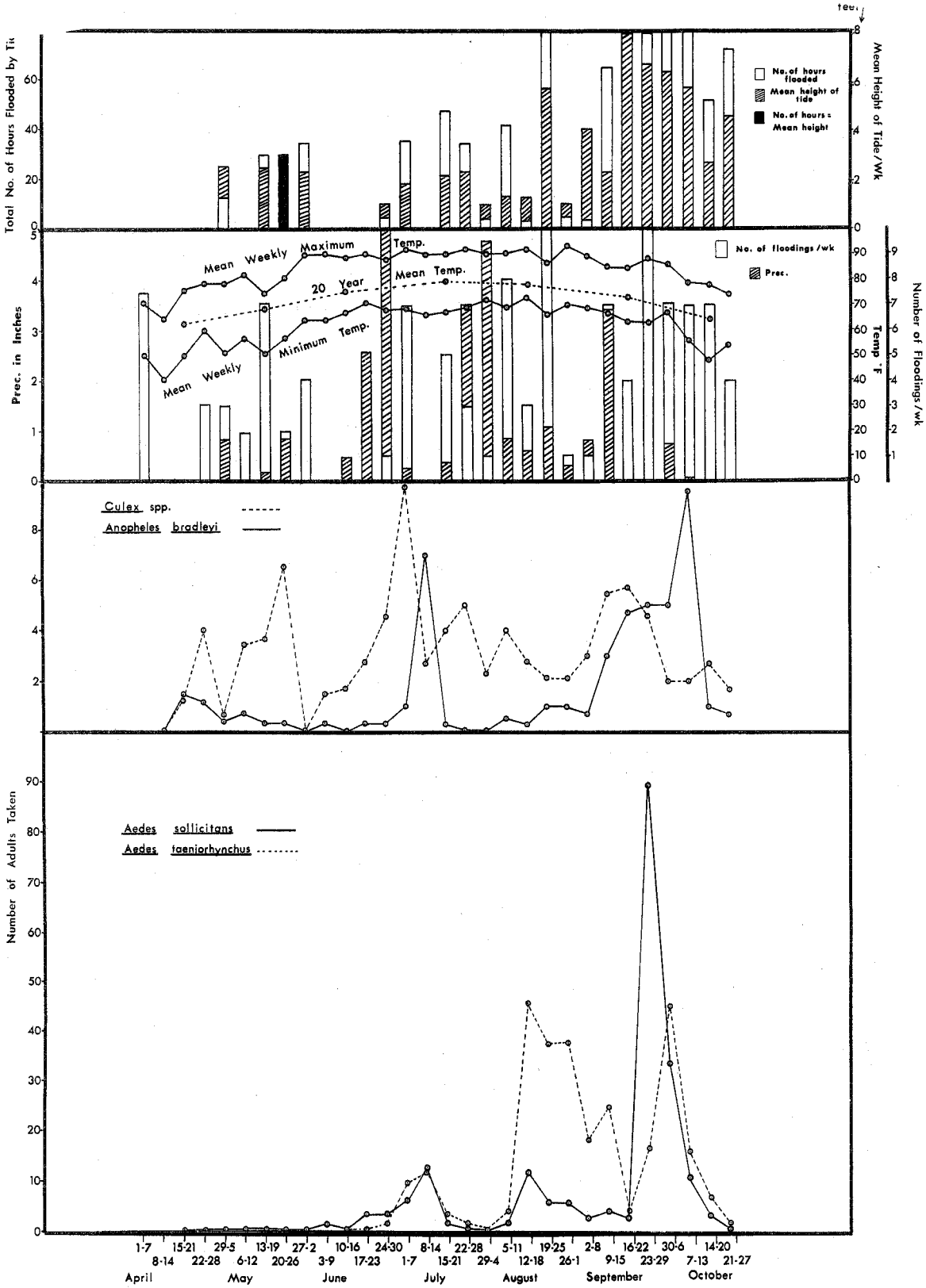

FIG. 16 Mean Number of Adults Taken per Light Trap Night per Week at the Oriental Light Trap

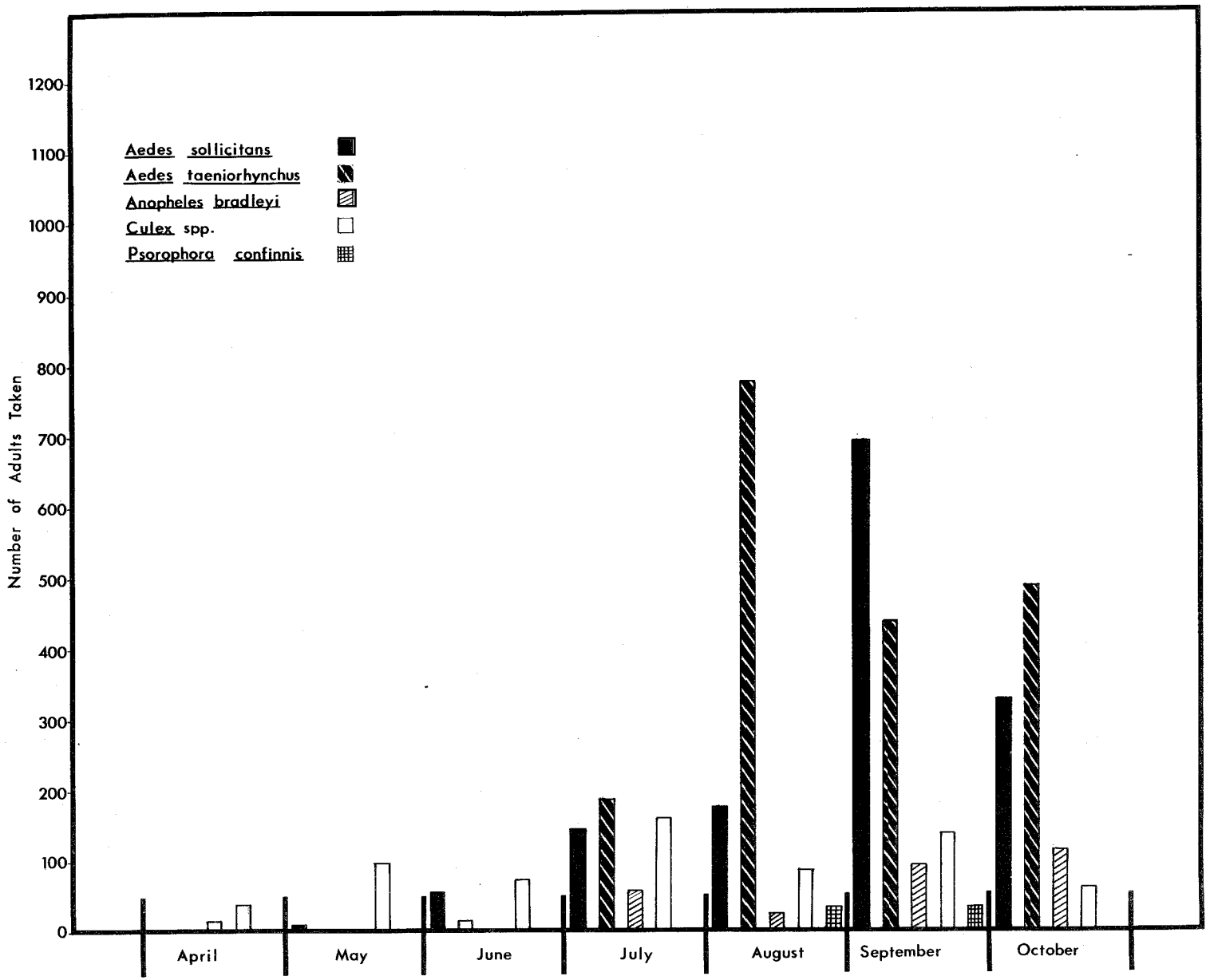

FIG. 17 Total Number of Adults Taken per Month at the Oriental Light trap

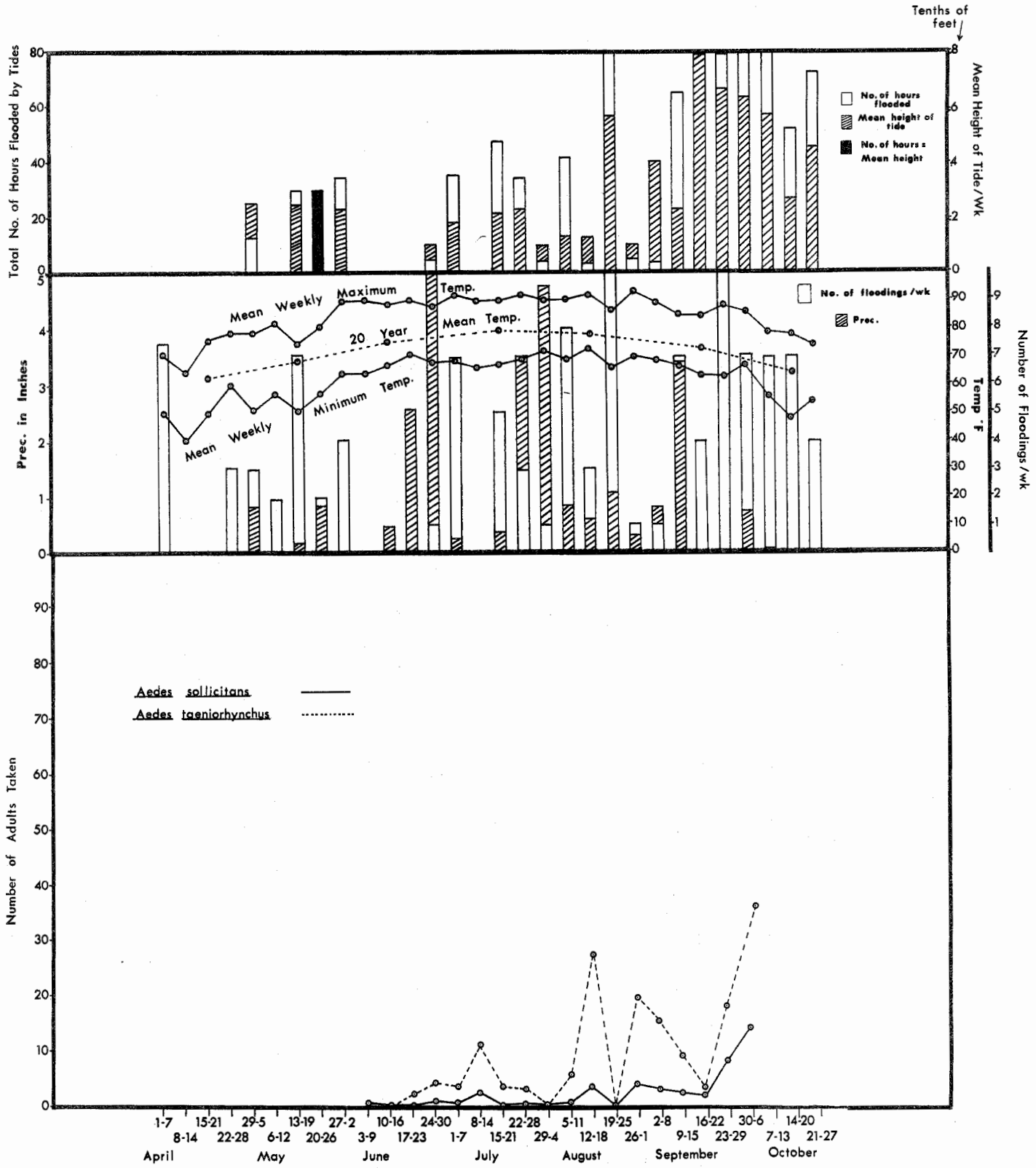

FIG. 18 Mean Number of Adults Taken per 10 min Interval per Week during Biting Counts at Oriental, N.C. 1973

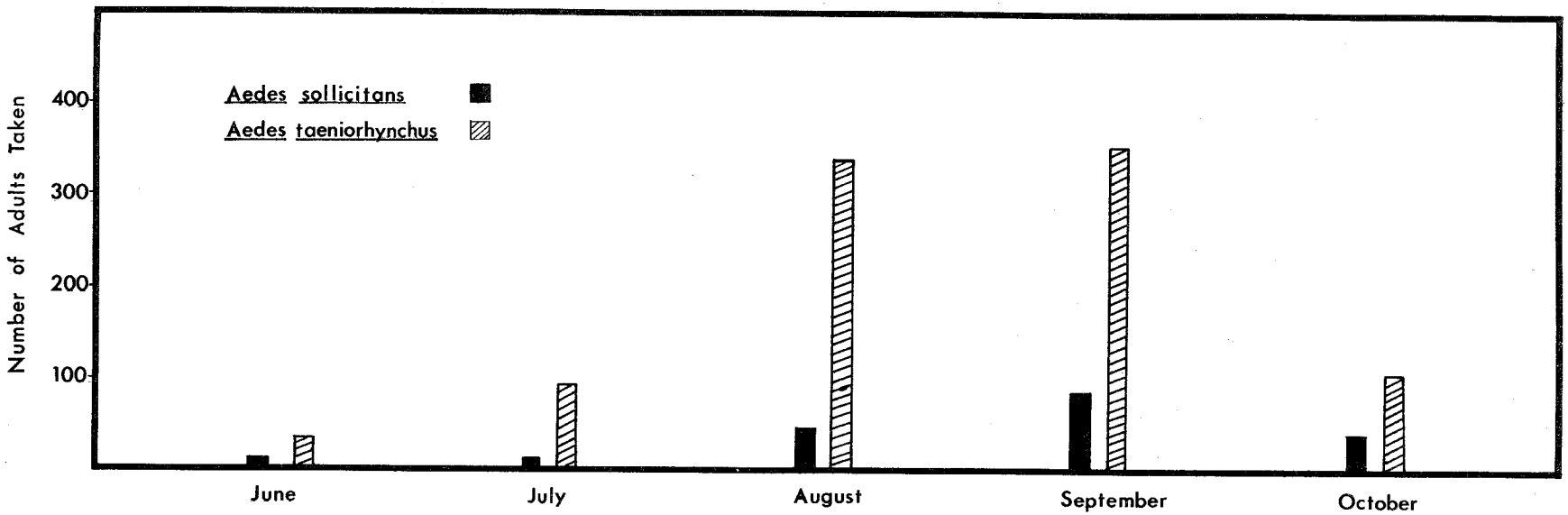

FIG. 19 Total Number of Adults Taken per Month during Biting Counts at Oriental, N.C. 1973

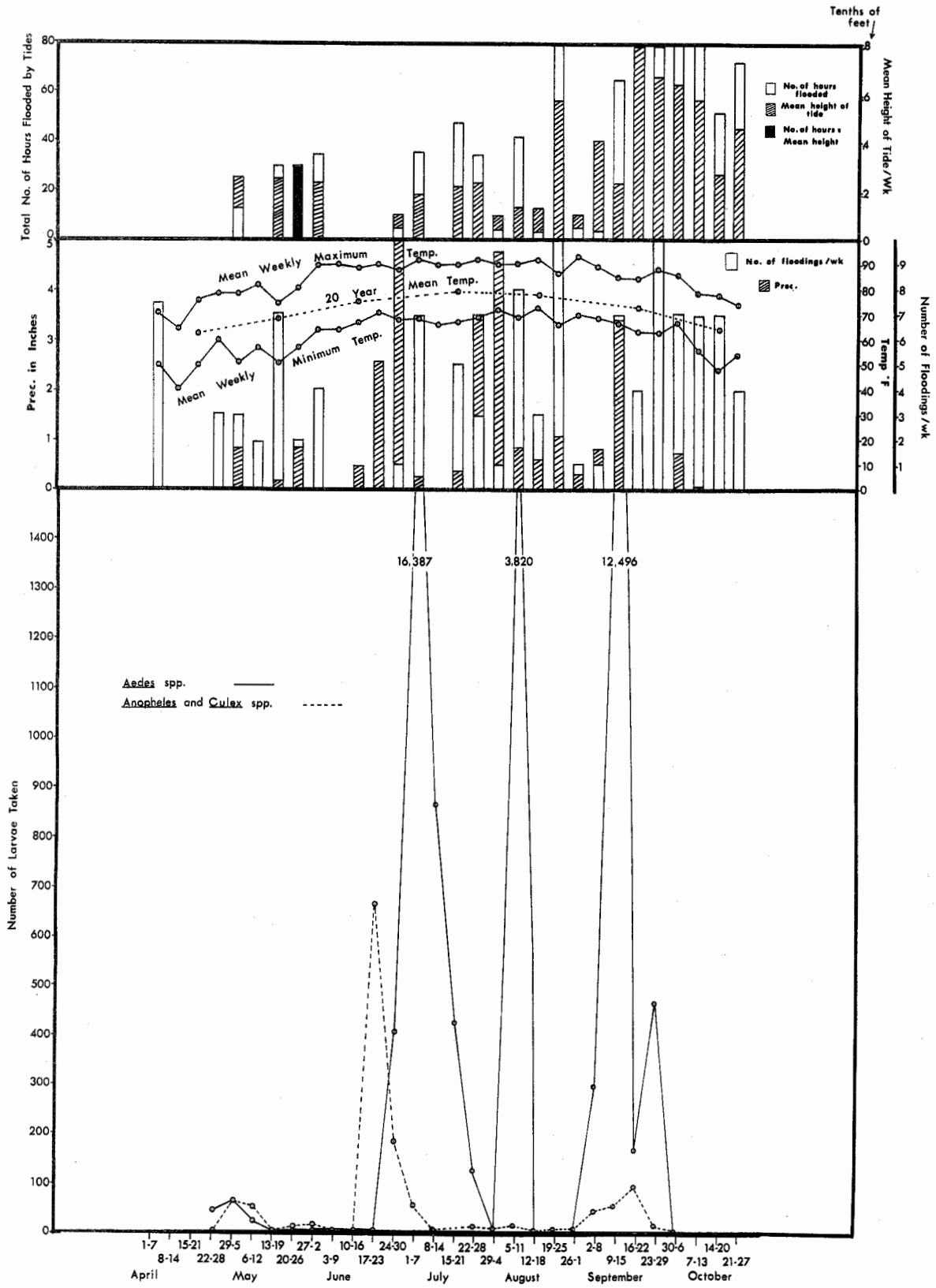

FIG. 20 Total Number of Larvae Taken per Week from Unimpounded Sites at the Florence-Whortonsville Area, 1973

Table 1. Summary of the Physical Characteristics, Frequency, Duration and Extent of Flooding of Unimpounded Study Area, Kings Point, Carteret County, North Carolina, 1972.

No. of Sites	Depth of water (inches)		Surface area (sq.ft.)		Slope index		Frequency of flooding/ month (at tide gauge)		Frequency of flooding/ month (at site)	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
21	6.2	3.0-10.5	377	5.0-2500	.17	.05-.83	24	11-43	20.8	1-27

Table 1. (Continued)

No. of Sites	Frequency of standing water (%)		Number of wet intervals/site		Mean number of days/ wet interval		Number of dry intervals/site		Mean number of days/ wet interval	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
21	80.0	14-100	4.4	1-11	88.4	3.0-240	3.7	0-11	8.4	0-32.3

Table 2. Summary of the Physical Characteristics, Frequency, Duration and Extent of Flooding of Unimpounded Study Area, Florence-Whortonsville Area, Pamlico County, North Carolina, 1973.

No. of Sites	Depth of water (inches) Mean	Range	Surface area (sq.ft.) Mean	Range	Slope index Mean	Range	Frequency of flooding/ month (at site) Mean	Range	Frequency of standing water (%) Mean	Range
18	4.8	3-18	305.8	4-1000	.16	.05-.75	8.0	3.7-14.5	46.7	7-100

Table 2. (Continued)

No. of Sites	Number of wet intervals Mean	Range	Mean number of days/ wet interval Mean	Range	Number of dry intervals Mean	Range	Mean number of days/ dry interval Mean	Range
18	6.8	1.0-11.0	17.4	3.5-161	6.3	0.0-11.0	13.3	0-44.6

Table 3. Plant Cover Summary for Unimpounded Study Area; Kings Point, Carteret County, North Carolina 1972. (In percentage)

Number of Sites	Juncus roemerianus	Distichlis spicata	Spartina patens	Baccharis halimifolia	Borrichia frutescens	Cladium jamaicense	Salicornia virginica
21	49.0	16.4	26.0	0.95	0.8	2.1	4.7

Table 4. Summary of Physical and Vegetational Data for Smyrna Creek Impoundment, Williston, Carteret County, North Carolina. 1972.

No. of Sites	Surface Area (Sq.ft.)		Water Depth (Site) (Inches)		Salinity 0/00		Plant Cover (0/0) J. roemerianus	D. spicata	S. patens	Typha sp.	Borrichia frutescens	Baccharis halimifolia	No emergent veget.
	Mean	Range	Mean	Range	Mean	Range							
12	160	50-400	17	5-40	2.3	0.5-4.0	48.3	14.1	3.3	21.6	.83	.41	12.0

Table 5. Plant Cover Summary for the Unimpounded Study Area, Florence-Whortonsville, Pamlico County, North Carolina, 1973. (In percentage)

No. of Sites	*Juncus roemerianus*	*Distichlis spicata*	*Spartina patens*	*Borrichia frutescens*	*Scirpus robustus*
18	9.7	62.0	25.3	2.7	.27

Table 6. Summary of Physical and Vegetational Data for Impoundments 1 - 3, Florence-Whortonsville, Pamlico County, North Carolina, 1973.

Impoundment number	No. of sites	Surface area (sq.ft.)	Site Water depth (inches) Mean	Range	Floodgate Water depth (inches) Mean	Range	Salinity (0/00) Mean	Range	Plant Cover (0/0) *Juncus roemerianus*	*Ruppia maritima*	No emergent vegetation
1	10	50	2.3	1.0-4.0	7.06	5.0-10.0	8.9	8.0-11.0	0	30	70
2	12 + transect	50	5.3	1.5-13.0	11.8	8.6-15.0	7.8	6.3-10.3	50	50	0
3	10	50	2.5	1.0-4.5	8.7	6.0-11.0	10.8	6.6-15.0	0	10	90

Table 7. Summary of Mosquito Abundance Data for Unimpounded Study Area, Kings Point, Carteret County, North Carolina, 1972. (Percentage/raw number)

No. of Sites	Breeding index Mean	Range	Total No. specimens taken	Total No. specimens identified	Aedes and Psorophora	Anopheles and Culex	Aedes taeniorhynchus
21	6.5	0.0-276.0	1605	1558	35/545	65/1013	2/31

Table 7. (Continued)

No. of Sites	Aedes sollicitans	Other Aedes spp.	Anopheles atropos	Anopheles bradleyi	Anopheles (2nd instar)	Culex salinarius
21	30/467	3/47	6/94	19/296	38/592	2.0/31

Table 8. Summary of Mosquito Abundance Data for Smyrna Creek Impoundment, Williston, Carteret County, North Carolina, 1972. (Percentage/raw number)

No. of Sites	Breeding index Mean	Breeding index Range	Total specimens taken	Total specimens identified	Aedes and Psorophora	Anopheles and Culex	Anopheles 2nd instar	Culex salinarius
12	1.09	.05-94.5	178	178	0/0	100/178	3/5	97/173

Table 9. Summary of Mosquito Abundance Data for Unimpounded Study Area, Florence-Whortonsville, Pamlico County, North Carolina, 1973. (Percentage/raw number)

No. of Sites	Breeding index Mean	Breeding index Range	Total No. specimens taken	Total No. specimens identified	Aedes	Anopheles and Culex	Aedes taeniorhynchus	Aedes sollicitans	Anopheles bradleyi	Culex spp.
18	144.8	.016-1500.0	36,891	35,968	96.5/34,687	3.5/1281	54.2/18943	42.3/15744	3.3/1203	.2/78

Table 10. Summary of Mosquito Abundance Data for Impoundments 1 - 3, Florence-Whortonsville, Pamlico County, North Carolina, 1973. (Percentage/raw number)

Impoundment	Breeding index Mean	Breeding index Range	Total No. specimens taken	Total No. specimens identified	Aedes	Anopheles and Culex	Anopheles bradleyi	Anopheles quadri-maculatus	Culex salinarius
1	-	-	-	-	-	-	-	-	-
2	334.7	0.1-1800	107	107	0/0	100/107	94/100	3/3	3/4
3	-	-	-	-	-	-	-	-	-

Table 11. Data on Effects of Water Level on Mosquito Abundance along transect in Impoundment No. 2, Florence-Whortonsville, Pamlico County, North Carolina, 1972.

Date	Mean water level along transect (inches)	Breeding index	Number of specimens taken	Species
June 14	12.0	-		
15	9.3	-		
20	9.0	60.00	3	Anopheles bradleyi
22	7.0	-		
27	9.0	11.20	3	Anopheles bradleyi
July 4	9.5	10.00	1	Anopheles bradleyi
18	7.0	10.00	1	Anopheles bradleyi
27	7.5	1800.00	42	Anopheles bradleyi
Aug 1	8.0	1700.00	38	32 Anopheles bradleyi, 3 An. quadrimaculatus, 3 Culex salinarius
6	13.0	365.00	10	Anopheles bradleyi
8	12.0	-		
13	12.0	10.00	1	Anopheles bradleyi
31	11.5	-		
Sept 3	11.0	-		
12	10.0	10.00	1	Anopheles bradleyi
17	10.0	10.00	1	Anopheles bradleyi
24	8.5	10.00	1	Anopheles bradleyi
Oct 1	8.0	20.00	2	Anopheles bradleyi

APPENDIX

Table 1. Data on the Physical Characteristics, Frequency, Duration and Extent of Flooding at Kings Point Study Sites, 1972.

Site No.	Depth of water (in inches)	Surface area (sq.ft.)	Slope Index	Frequency of flood. month	Frequency of standing water (%)	Number of wet periods	Mean number of days/wet period	Number of dry periods	Mean number of days/ dry period
1	6.0	50	.8300	17.6	75	6	26.0	5	10.0
2	5.0	2500	.0500	22.00	70	7	21.0	6	11.0
3	7.0	100	.1000	27.00	93	2	99.0	1	13.0
4	6.0	400	.0500	19.60	77	7	23.0	6	7.0
5	7.0	50	.2000	22.00	82	6	29.0	5	7.0
6	7.0	200	.1000	23.20	100	1	240.0	0	0.0
7	9.0	25	.1000	27.00	100	1	240.0	0	0.0
8	8.0	100	.1300	27.00	100	1	240.0	0	0.0
9	10.5	150	.1700	27.00	100	1	240.0	0	0.0
10	3.0	200	.0500	27.00	98	3	68.0	2	2.0
11	5.0	150	.0800	15.20	63	5	26.4	5	15.0
12	3.0	400	.0500	17.60	53	10	11.2	9	10.0
13	4.0	150	.0500	17.60	38	11	7.3	11	12.1
14	7.0	50	.1500	23.20	95	3	66.3	2	8.5
15	6.0	1500	.1000	23.20	98	2	103.0	1	11.0
16	8.0	50	.2000	27.00	100	1	240.0	0	0.0
17	6.0	100	.1000	19.60	99	2	104.0	1	10.0
18	6.0	150	.1000	19.60	73	7	22.0	6	8.0
19	4.0	5	.2300	1.00	14	6	5.0	6	32.3
20	7.0	1500	.1500	12.20	67	8	18.0	7	9.6
21	6.5	100	.5400	13.60	76	6	27.0	5	8.0

Table 2. Data on Physical Characteristics, Frequency, Duration and Extent of Flooding of Unimpounded Marsh Sites, Florence-Whortonsville Area, Pamlico County, North Carolina, 1973.

	Depth of water (inches)	Surface area (sq.ft.)	Slope index	Frequency of flooding/ month	Frequency of standing water (%)	Number of wet intervals	Mean No. of days per wet interval	Number of dry intervals	Mean No. of days per dry interval
1	18.0	80.0	.75	14.5	100.0	1.0	161.0	0.0	0.0
2	3.0	4.0	.25	6.5	41.0	9.0	7.1	8.0	11.1
3	3.0	150.0	.05	6.5	41.0	9.0	6.9	8.0	11.1
4	3.5	300.0	.06	6.5	42.0	9.0	7.1	8.0	11.1
5	6.0	100.0	.10	8.7	48.0	7.0	10.8	6.0	13.2
6	6.0	100.0	.50	8.0	51.0	7.0	11.1	6.0	12.3
7	6.0	50.0	.50	8.0	64.0	4.0	15.5	3.0	11.6
8	3.0	1000.0	.05	8.0	87.0	3.0	23.0	2.0	5.0
9	3.0	200.0	.05	9.0	45.0	11.0	6.2	11.0	7.4
10	4.5	200.0	.08	9.0	33.0	11.0	4.8	11.0	9.5
11	4.0	500.0	.05	8.1	32.0	9.0	5.5	9.0	12.0
12	4.0	500.0	.05	8.1	33.0	8.0	6.5	8.0	13.0
13	4.5	20.0	.20	10.5	64.0	8.0	12.7	7.0	8.0
14	4.5	500.0	.05	10.5	63.0	9.0	11.0	8.0	7.2
15	3.0	200.0	.05	3.7	13.0	3.0	8.3	3.0	44.6
16	3.0	500.0	.05	4.7	13.0	6.0	4.0	6.0	22.0
17	3.0	500.0	.05	4.0	7.0	4.0	3.5	4.0	36.0
18	5.5	650.0	.07	10.0	65.0	7.0	8.0	6.0	5.0

Table 3. Plant Cover Summary for King's Point Study Sites, 1972 (in percentage).

Site No.	Juncus roemerianus	Distichlis spicata	Spartina patens	Spartina alterniflora	Baccharis halimifolia	Borrichia frutescens	Panicum virgatum	Cladium jamaicense	Salicornia virginica	Scirpus robustus	Iva ciliata	Pinus taeda	Myrica cerifera
1	0	0	95	0	0	0	0	5	0	0	0	0	0
2	5	0	95	0	0	0	0	0	0	0	0	0	0
3	100	0	0	0	0	0	0	0	0	0	0	0	0
4	85	0	0	0	0	15	0	0	0	0	0	0	0
5	100	0	0	0	0	0	0	0	0	0	0	0	0
6	30	70	0	0	0	0	0	0	0	0	0	0	0
7	100	00	0	0	0	0	0	0	0	0	0	0	0
8	100	0	0	0	0	0	0	0	0	0	0	0	0
9	80	20	0	0	0	0	0	0	0	0	0	0	0
10	55	45	0	0	0	0	0	0	0	0	0	0	0
11	0	0	80	0	0	0	0	20	0	0	0	0	0
12	0	0	80	0	0	0	0	20	0	0	0	0	0
13	0	0	0	0	0	0	0	0	100	0	0	0	0
14	100	0	0	0	0	0	0	0	0	0	0	0	0
15	10	0	90	0	0	0	0	0	0	0	0	0	0
16	50	50	0	0	0	0	0	0	0	0	0	0	0
17	60	40	0	0	0	0	0	0	0	0	0	0	0
18	40	60	0	0	0	0	0	0	0	0	0	0	0
19	80	0	0	0	20	0	0	0	0	0	0	0	0
20	30	60	10	0	0	0	0	0	0	0	0	0	0
21	0	0	100	0	0	0	0	0	0	0	0	0	0

Table 4. Data on the Physical and Vegetational Characteristics for each site at Smyrna Creek Impoundment, Williston, North Carolina, 1972.

Site No.	Surface area (sq.ft.)	Depth of water (inches) Mean	Range	Salinity (0/00) Mean	Range	Plant Cover (In percentage) *Juncus roemerianus*	*Distichlis spicata*	*Spartina patens*	*Typha* sp.	*Borrichia frutescens*	*Baccharis halimifolia*
1	150	10	8-13	3.0	2.0-4.0		80	20			
2	50	18	16-19	2.5	2.0-4.0	50	25	20			
3	100	22	21-23	3.0	2.5-3.0	100					
4	200	24	20-26	3.0	-				100		
5	100	17	5-40	2.0	-	10	10		80		
6	100	8	8-11	2.3	2.0-3.0	100					
7	100	14	12-13	1.8	0.5-2.0	10	10		80		
8	100	12	12-13	2.5	2.0-3.0	100					
9	100	16	15-18	2.8	2.0-3.5	10	75			10	5
10	100	19	-	3.0	2.0-4.0						
11	400	20	19-22	2.0	1.5-2.0	100					
12	400	22	21-23	0.0	-	100					

Table 5. Plant Cover Summary for Unimpounded Marsh Sites, Florence-Whortonsville Area, Pamlico County, North Carolina, 1973. (In percentage)

Site Number	*Juncus roemerianus*	*Distichlis spicata*	*Spartina patens*	*Borrichia frutescens*	*Scirpus robustus*
1	100	0	0	0	0
2	0	50	50	0	0
3	0	50	50	0	0
4	0	30	70	0	0
5	0	80	15	0	5
6	10	50	40	0	0
7	0	50	50	0	0
8	0	20	80	0	0
9	0	100	0	0	0
10	0	100	0	0	0
11	5	95	0	0	0
12	0	100	0	0	0
13	5	95	0	0	0
14	5	95	0	0	0
15	50	0	0	50	0
16	0	50	50	0	0
17	0	50	50	0	0
18	0	100	0	0	0

Table 6. Abundance of Aedes-Psorophora and Anopheles-Culex Species at Kings Point Study Sites, 1972. (Percentage/raw number)

Site No.	Mean breeding index	Range	Total specimens taken/site	Total specimens identified	Aedes and Psorophora	Anopheles and Culex	Aedes sollicitans
1	2.80	.050-23.5	178	178	20/36	80/142	17/31
2	20.00	2.500-90.0	21	21		100/21	
3	10.00	.1 -63.0	298	298	1/3	99/295	1/2
4	2.50	.4 - 9.6	16	16		100/16	
5	1.20	.05 - 2.4	77	77		100/77	
6	0.61	.20 - 1.8	22	22		100/22	
7	0.18	.03 - 1.4	26	26		100/26	
8	1.10	.10 - 8.4	27	27		100/27	
9	0.28	.15 - 0.6	16	16		100/16	
10	0.80	.20 - 2.4	11	11		100/11	
11	1.10	.15 - 2.4	14	14	7/1	93/13	
12	3.40	.40 -16.0	19	19		100/19	
13	0.15	-	1	1		100/1	
14	0.40	.05 - 2.1	27	27		100/27	
15	10.70	.15 -55.3	110	110		100/110	
16	0.26	.05 - 1.25	22	22	5/1	95/21	5/1
17	0.68	.10 - 3.0	31	31	4/1	96/30	
18	0.45	.15 - 1.35	11	11	27/3	73/8	18/2
19	0.05	.005- .20	18	18	100/18		95/17
20	65.20	1.5 -276.0	387	387	98/38	2/6	92/357
21	12.80	.1 -69.0	273	226	49/107	51/119	26/60

Table 6. (Continued)

Site No.	Aedes taeniorhynchus	Aedes atlanticus	Other Aedes spp.	Other Psorophora spp.	Anopheles atropos	Anopheles bradleyi	Anopheles 2nd instar	Culex salinarius
1	0.5/1		2/4		6/12	24/43	50/86	0.5/1
2						50/10	50/11	
3	1/1				1/2	24/72	73/198	
4					32/5	6/1	62/10	
5					24/18	40/31	36/28	
6					23/5	41/9	36/8	
7					27/7	27/7	46/12	
8					40/11	26/7	33/9	
9					31/5	13/2	56/9	
10					18/2	18/2	64/7	
11			7/1			15/2	78/11	
12						79/15	2/14	
13							100/1	
14					11/3	26/7	63/17	
15					8/9	18/20	74/81	
16					9/2	50/11	36/8	
17	4/1				6/2	61/19	29/9	
18			9/1		9/1	55/6	9/1	
19	5/1							
20	6/24				1/2	1/3	1/1	
21	1/2	2/4	17/40	3/1		12/25	31/71	8/23

Table 7. Data on the Mosquito Abundance for each site at Smyrna Creek Impoundment, Williston, North Carolina, 1972. (Percentage/raw number)

Site No.	Breeding index Mean	Range	Total specimens taken	Total specimens identified	Aedes and Psorophora	Anopheles and Culex	Anopheles 2nd instar	Culex salinarius
1	12.60	0-94.50	173	173	0/0	100/173		100/173
2	0.0036	0-00.05	1	1	0/0	100/1	100/1	
3	0.00	0	0	0	0/0			
4	0.00	0	0	0	0/0			
5	0.013	0-0.10	1	1	0/0	100/1	100/1	
6	0.29	0-0.40	2	2	0/0	100/2	100/2	
7	0.00	0	0	0	0/0			
8	0.00	0	0	0	0/0			
9	0.00	0	0	0	0/0			
10	0.00	0	0	0	0/0			
11	0.26	0-0.40	1	1	0/0	100/1	100/1	
12	0.00	0	0	0	0/0			

Table 8. Abundance of Aedes and Anopheles, Culex Species in Unimpounded Marsh Sites, Florence-Whortonsville, Pamlico County, North Carolina, 1973. (Percentage/raw number)

Site No.	Breeding Index Mean	Breeding Index Range	Total specimens taken/site	Total specimens identified	Aedes	Anopheles and Culex
1	33.40	.08-364.8	970	922	.3/3	99.7/919
2	.37	.016-1.5	62	62	71/44	39/18
3	12.41	.150-49.9	67	67	82/55	18/12
4	12.36	1.20-43.2	42	42	62/26	38/16
5	33.08	0.1-82.0	720	720	91/656	9/64
6	28.80	0.4-78.0	957	957	95/908	5/49
7	217.97	.05-798.0	30,394	30,394	99.5/30,365	.5/29
8	25.6	1.00-54.0	36	36	81/29	19/7
9	11.25	.20-36.8	88	85	85/72	15/13
10	138.50	.20-548.0	491	234	99/231	1/3
11	89.75	2.0 -225.0	126	73	94/69	5/4
12	390.00	2.0 -1500.0	558	195	95/185	5/10
13	.53	.08-1.5	124	124	49/60	51/64
14	73.03	.50-555.0	292	185	72/134	28/51
15	385.30	33.60-900.0	585	507	100/506	0/0
16	.50	-	4	4	50/2	50/2
17	.50	-	1	1	100/1	0/0
18	1161.45	.65-5525.0	1374	1350	99/1335	1/15

Table 8. (Continued)

Site No.	Aedes taeniorhynchus	Aedes sollicitans	Anopheles bradleyi	Culex spp.	
1	.3/3	0/0	94/866	5.7/53	
2	19/2	52/32	29/18	0/0	
3	7/5	75/50	18/12	0/0	
4	8/3	54/23	38/16	0/0	
5	42/300	49/356	9/64	0/0	
6	46/434	49/474	4/42	1/7	
7	57/17438	42.5/12927	.04/15	.039/14	
8	25/9	56/20	19/7	0/0	
9	20/17	65/55	15/13	0/0	
10	21/48	78/183	1/3	0/0	
11	27/20	67/49	4/3	1/1	
12	51/100	44/85	5/10	0/0	
13	5/6	46/54	50/63	1/1	
14	27/50	45/84	27/49	1/2	
15	65/330	34.7/176	0/0	0/0	.3/1 (Aedes vexans)
16	0/0	50/2	50/2	0/0	
17	100/1	0/0	0/0	0/0	
18	52/695	47/640	1/15	0/0	

Table 9. Data on the Mosquito Abundance for each perimeter site in Impoundment No. 2, Florence-Whortonsville Area, Pamlico County, North Carolina, 1973. (Percentage/raw number)

Site No.	Breeding index Mean	Range	Total specimens taken	Total specimens identified	Aedes and Psorophora	Anopheles and Culex	Anopheles bradleyi	Culex salinarius
1	0.1	-	1	1	0/0	100/1	0/0	100/1
2	0.4	-	2	2	0/0	100/2	100/2	0/0
3	0.0	-	0	0	0	0	0	0
4	0.0	-	0	0	0	0	0	0
5	0.0	-	0	0	0	0	0	0
6	0.0	-	0	0	0	0	0	0
7	0.0	-	0	0	0	0	0	0
8	0.0	-	0	0	0	0	0	0
9	0.0	-	0	0	0	0	0	0
10	0.0	-	0	0	0	0	0	0
11	0.0	-	0	0	0	0	0	0
12	0.0	-	0	0	0	0	0	0

Table 10. Total Number of Larvae taken per Weekly Interval from The King's Point Study Sites (Unditched) 1972. (Based on Total Number Identified)

Date	*Aedes* and *Psorophora*																					
Site No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
Mar. 4-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
11-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	30
25-31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	13
Apr. 1- 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	1	33
8-14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
15-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-May 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	17
6-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5
13-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	3
27-Jun 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
3- 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
10-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	5
17-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July 1- 7	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	30	73
8-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
15-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1	3	11
22-28	13	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	195	12	224
29-Aug 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	66	0	67
5-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Sep. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2- 8	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	8	5	47	62
9-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
16-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
23-29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
30-Oct. 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00	0	0	0	0

Table 10. (Continued)

Date	Anopheles and Culex																					
Site No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
Mar. 4-10	4	0	0	0	0	1	1	0	0	0	0	2	0	0	0	0	1	0	0	0	0	9
11-17	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
18-24	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
25-31	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	8
Apr. 1- 7	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3
8-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-May 5	8	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	12
6-12	17	2	17	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43
13-19	3	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
20-26	0	0	4	1	11	0	1	0	1	0	0	0	0	2	4	0	1	0	0	0	0	25
27-Jun 2	4	0	3	0	1	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	13
3- 9	4	3	2	1	4	1	9	2	2	1	0	0	0	3	2	2	3	2	0	0	3	44
10-16	4	0	37	0	5	1	3	2	1	1	1	2	0	1	4	2	2	0	0	1	16	83
17-23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-30	0	0	6	0	0	1	0	1	2	0	0	0	0	0	1	0	2	0	0	0	0	13
July 1- 7	10	2	21	0		2	1	1	2	1	0	0	0	1	1	2	3	0	0	0	21	71
8-14	7	1	15	0	1	0	0	0	1	2	2	0	0	0	0	0	2	0	0	0	2	33
15-21	5	0	28	0	3	1	1	1	0	0	0	0	0	0	2	0	3	0	0	0	12	56
22-28	35	2	13	2	13	3	0	1	1	0	4	8	0	0	0	0	6	0	0	1	29	118
29-Aug 4	4	0	20	0	7	0	2	0	2	0	0	0	0	2	2	2	0	0	0	0	7	48
5-11	0	0	9	0	0	2	0	0	0	0	0	0	0	1	10	2	0	0	0	0	0	24
12-18	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
19-25	0	0	63	1	13	0	0	0	0	0	0	0	0	3	41	0	0	0	0	0	0	121
26-Sep 1	0	0	9	0	0	2	1	3	1	2	0	0	0	0	0	5	3	0	0	0	1	27
2- 8	9	0	9	6	6	3	4	12	1	0	1	2	1	7	32	0	0	2	0	0	4	99
9-15	0	2	0	2	0	1	0	1	0	0	0	2	0	1	11	1	3	0	0	0	4	28
16-22	7	0	5	0	2	0	0	0	2	0	0	00	0	0	0	0	0	0	0	0	6	22
23-29	0	9	0	3	0	3	0	2	0	4	0	2	0	5	0	3	1	3	0	0	13	48
30-Oct 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11. Total Number of Larvae taken per Weekly Interval from Unimpounded Sites at Florence-Whortonsville, Pamlico County, North Carolina, 1973.

Aedes and Psorophora

Date	Site number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Apr 22-28	0	0	0	0	27	20	-	-	0	0	0	0	0	0	0	0	0	0	47
29-May 5	0	0	0	0	51	13	-	-	0	0	0	0	1	1	0	0	0	0	66
May 6-12	0	0	0	0	4	4	-	-	6	8	0	3	0	0	0	0	0	0	25
13-19	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
20-26	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
27-Jun 2	0	0	0	0	0	0	-	-	0	1	1	3	0	0	0	0	0	0	5
Jun 3-9	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
10-16	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
17-23	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
24-30	0	0	0	0	0	0			23	70	35	151	9	120	0	0	0	0	408
Jul 1-7	0	2	0	0	35	385	15,960	-	0	0	0	0	0	2	0	0	0	4	16,387
8-14	0	0	0	0	1	1	0	-	0	0	0	0	5	6	0	0	0	850	863
15-21	0	0	0	0	0	0	0	12	23	274	0	0	36	78	0	0	0	0	423
22-28	3	0	0	0	0	0	0	7	8	31	0	0	4	13	0	0	0	56	122
29-Aug 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-11	0	3	1	4	38	19	3,590	1	7	2	36	61	0	0	23	0	0	35	3,820
12-18	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Sep 1	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4
2-8	0	0	0	0	0	0	0	3	0	104	50	29	2	6	0	0	0	97	291
9-15	0	42	43	15	509	467	10,810	6	1	0	0	300	3	13	0	0	0	287	12,496
16-22	0	1	4	9	5	0	0	1	3	0	0	0	0	2	112	2	1	23	163
23-29	0	0	8	0	1	0	1	0	0	0	0	1	0	0	450	0	0	0	461
30-Oct 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11. (Continued)

Date	Site number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
									Anopheles and Culex										
Apr 22-28	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
29-May 5	24	0	0	0	5	14	-	-	0	0	0	0	10	12	0	0	0	0	65
6-12	17	5	0	0	1	11	-	-	0	1	0	4	6	8	0	0	0	0	53
13-19	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
20-26	2	0	1	0	0	4	-	-	0	0	0	0	0	4	0	0	0	0	11
27-Jun 2	1	0	1	0	1	9	-	-	1	0	1	0	2	2	0	0	0	0	18
3-9	1	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	1
10-16	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
17-23	662	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	662
24-30	184	0	0	0	0	0	-	-	0	0	0	1	1	2	0	0	0	0	188
Jul 1-7	45	0	0	2	3	3	0	-	0	0	0	0	3	1	0	0	0	0	57
8-14	2	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	2
15-21	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
22-28	3	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	4	12
29-Aug 4	1	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	10
5-11	1	0	0	0	1	0	0	0	0	0	0	0	7	2	0	0	0	4	15
12-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-25	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	8
26-Sep 1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
2-8	6	0	0	0	0	0	17	0	0	0	0	0	14	3	0	0	0	3	43
9-15	3	1	0	0	44	0	0	0	0	0	0	0	4	1	0	0	0	0	53
16-22	5	8	9	13	5	1	0	7	12	1	3	3	5	14	0	2	0	3	91
23-29	0	0	0	2	3	7	3	0	0	0	0	2	0	0	0	0	0	1	18
30-Oct 6	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2

Table 12. Mean Number of Adult Mosquitoes taken per Light Trap Night per Week at the Davis Light Trap, 1972.

Date light trap week	No. of nights light trap in operation	Aedes sollicitans	Aedes taeniorhynchus	Aedes atlanticus	Anopheles atropos	Anopheles bradleyi	Culex salinarius	Psorophora confinnis
Feb 25-Mar 3	7							
Mar 4-10	7				0.57	0.57	0.70	
11-17	7					0.20	0.80	
18-24	5				0.28	0.57	0.28	
25-31	5					0.66	0.16	
Apr 1-7	6				0.14		0.43	
8-14	7							
15-21	7	0.43			0.14	1.10	3.30	
22-28	7				0.43	0.57	1.10	
29-May 5	7	0.70			0.28	0.85	1.30	
6-12	7	0.59			0.70	0.14	1.10	
13-19	7	0.43	0.14		0.28	3.30	4.30	
20-26	7	0.43	0.28					
27-Jun 2	7				0.28	1.70	10.50	10.40
Jun 3-9	7	2.70	0.43		9.00	25.00	10.70	49.00
10-16	7	27.00	8.30	12.40	10.80	16.50	5.60	13.50
17-23	7	13.70	7.40	1.70	4.10	4.30	1.00	0.28
24-30	7	2.70	1.40		4.10	15.30	1.50	0.43
Jul 1-7	7	4.00	4.70	2.00	2.00	8.70	2.30	2.00
8-14	7	5.00	6.00	2.00	0.28	0.70	2.40	0.28
15-21	7	0.57	1.50	0.43		2.00	1.40	9.40
22-28	7	16.00	5.40	3.10		0.43		2.70
29-Aug 4	7	2.30	3.00	0.43	1.10	2.50	0.70	4.00
5-11	7	6.30	4.30	1.00	6.00	14.30	2.00	18.40
12-18	7	30.00	64.00	2.10	9.00	14.00	1.30	2.70
19-25	7	15.00	20.00	0.28	10.50	2.60	2.00	2.00
26-Sep 1	7	12.70	33.00	0.28	6.00	14.30	0.28	0.28
Sep 2-8	7	30.00	54.00		6.00	16.00	3.70	
9-15	7	10.00	12.00		39.00	29.00	3.30	1.40
16-22	7	27.00	62.00		8.00	11.71	1.00	0.28
23-29	7	4.50	29.71		3.20	5.00	0.28	0.14
30-Oct 6	7	4.10	23.14		3.00	6.00	2.00	0.00
Oct 7-13	7	2.00	13.00		7.57	6.71	0.28	0.28
14-20	7	4.70	10.28		0.43	1.43	0.28	0.00
21-27	7	0.14	0.28					

Table 13. Total Number of Adult Mosquitoes taken per Month at the Davis Light Trap, 1972.

Species		March	April	May	June	July	August	September	October	Eight Month Total
Aedes	sollicitans	0	3	15	340	167	646	445	76	1,692
Aedes	taeniorhynchus	0	0	3	156	110	1,169	1,066	327	2,831
Aedes	atlanticus	0	0	0	112	42	26	4	1	185
Psorophora	confinnis	0	0	0	515	100	191	15	2	823
Anopheles	atropos	6	2	12	198	16	216	500	99	1,049
Anopheles	bradleyi	9	12	34	439	82	488	469	134	1,667
Culex	salinarius	11	27	55	196	43	41	59	21	453
Total for each month		26	44	119	1,956	560	2,777	2,594	660	8,700

Species		Mosquito Abundance %		
			Temporary Pool Breeders Aedes and Psorophora	Permanent Pool Breeders Anopheles and Culex
Aedes	sollicitans	19.4		
Aedes	taeniorhynchus	32.5		
Aedes	atlanticus	2.1		
Psorophora	confinnis	9.5	63.5	36.5
Anopheles	atropos	12.1		
Anopheles	bradleyi	19.2		
Culex	salinarius	5.2		
Total		100.0		

Table 14. Total Number of Adult Mosquitoes taken per ten-minute interval per half-hour during biting counts at Davis, 1972.

Date	Time (P.M.) of count	Aedes sollicitans	Aedes taeniorhynchus	Aedes atlanticus	Anopheles atropos	Anopheles bradleyi	Culex sal.	Psoro. con.
June 2	8:00- 8:30	1						
	8:30- 9:00	1	1	1		2		
	9:00- 9:30	2	2		1	9		
	9:30-10:00							
June 5	8:00- 8:30	1	1	19				1
	8:30- 9:00		2	3		4	1	
	9:00- 9:30		4	2	5	13		1
	9:30-10:00							
June 9	8:00- 8:30		1					
	8:30- 9:00							
June 12	8:00- 8:30			4				
	8:30- 9:00	1	1			1		
	9:00- 9:30	1	1		2	18		
	9:30-10:00							
June 16	8:00- 8:30		1	7				1
	8:30- 9:00	3	5	5				
	9:00- 9:30	10	4	1	2	1		
	9:30-10:00	2	1		3			
June 20	8:00- 8:30	0	0	0	0	0	0	0
	8:30- 9:00	1	1					
	9:00- 9:30	1	1					
	9:30-10:00							
June 28	8:00- 8:30		2	3				
	8:30- 9:00	1	1	1				
	9:00- 9:30	1	2			2		
	9:30-10:00	0	0	0	0	0	0	0
July 3	8:00- 8:30							
	8:30- 9:00	3		1				
	9:00- 9:30	10	6		1		1	
	9:30-10:00					1		
July 7	8:00- 8:30		2					
	8:30- 9:00			2				
	9:00- 9:30	0	0	0	0	0	0	0
	9:30-10:00	0	0	0	0	0	0	0
July 10	8:00- 8:30	0	0	0	0	0	0	0
	8:30- 9:00		1	1			1	
	9:00- 9:30			1	2	2		
	9:30-10:00		4			2		
July 17	8:00- 8:30	0	0	0	0	0	0	0
	8:30- 9:00	4	20		1			
	9:00- 9:30	12	23		6			4
	9:30-10:00	12	4		2			
July 26	8:00- 8:30		1	3				1
	8:30- 9:00	2	7	1		2		
	9:00- 9:30	8	10					
	9:30-10:00	4	2			1		
Aug. 2	8:00- 8:30	1	2	4				
	8:30- 9:00	4	22	7	1	2	1	1
	9:00- 9:30	2	7		1	2		
	9:30-10:00	1	4			7		1
	10:00-10:30				1	4		
Aug. 7	8:00- 8:30	1	7					
	8:30- 9:00	46	36			1		
	9:00- 9:30	18	6	1				2
	9:30-10:00	3	3		4	5		
Aug. 14	8:00- 8:30	5	27	1				
	8:30- 9:00	11	28					
	9:00- 9:30	4	15			16		
	9:30-10:00	4	3			7		

Table 14. (Continued)

Date	Time (P. M.) of count	Aedes sollicitans	Aedes taeniorhynchus	Aedes atlanticus	Anopheles atropos	Anopheles bradleyi	Culex sal.	Psoro. con.
Aug 25	8:00- 8:30	3	60		2			
	8:30- 9:00	1	45		8	1		
	9:00- 9:30		27		3			
	9:30-10:00	4	15		2	2		
Aug 30	8:00- 8:30	25	54		1	1		
	8:30- 9:00	4	17		9	1		
	9:00- 9:30		10		6	2		
	9:30-10:00		1		4	3		
Sep 8	7:30- 8:00		4					
	8:00- 8:30	1	4			2		
	8:30- 9:00					1		
Sep 12	7:30- 8:00	26	33	1		1		
	8:00- 8:30	7	20	1				
	8:30- 9:00	8	7		1	5		
Sep 26	7:00- 7:30	7	31					
	7:30- 8:00	3	22					
	8:00- 8:30	1	8					

Table 15. Total Number of Adult Mosquitoes taken per Month during Biting Counts at Davis, 1972.

Species		June	July	August	September	Four Month Total
Aedes	sollicitans	26	55	137	53	271
Aedes	taeniorhynchus	30	74	379	129	612
Aedes	atlanticus	45	9	13	2	69
Psorophora	confinnis	3	5	4	0	12
Anopheles	atropos	13	12	42	1	68
Anopheles	bradleyi	51	8	54	9	122
Culex	salinarius	1	2	1	0	4
Total for each month		169	165	630	194	1,158

Species			Mosquito Abundance % Temporary Pool Breeders Aedes and Psorophora	Permanent Pool Breeders Anopheles and Culex
Aedes	sollicitans	23.4		
Aedes	taeniorhynchus	52.8		
Aedes	atlanticus	6.0		
Psorophora	confinnis	1.0	83.2	16.8
Anopheles	atropos	5.9		
Anopheles	bradleyi	10.5		
Culex	salinarius	0.4		
Total		100.0		

Table 16. Mean Number of Adults taken per Light Trap Night per Week at Bayboro, North Carolina, 1973.

Date light trap week	No. of nights light trap in operation	*Aedes taeniorhynchus*	*Aedes sollicitans*	*Anopheles bradleyi*	*Culex* spp.	*Psorophora confinnis*
Apr 15-21	7	0.00	0.00	1.14	0.14	0.00
22-28	7	0.00	0.00	1.14	1.57	0.00
29-May 5	7	0.00	0.00	0.71	1.28	0.00
May 6-12	7	0.00	0.00	0.71	1.71	0.00
13-19	7	0.00	0.00	0.00	1.14	0.00
20-26	7	0.00	0.14	0.43	2.57	0.00
27-Jun 2	7	0.00	0.00	0.00	0.00	0.00
Jun 3-9	7	0.00	1.00	0.57	5.00	0.00
10-16	7	0.00	0.14	0.28	1.57	0.00
17-23	7	0.00	0.14	0.57	4.28	0.00
24-30	7	6.00	2.71	0.43	3.43	0.00
Jul 1-7	7	3.43	1.57	1.71	3.57	0.14
8-14	7	0.43	0.00	0.71	2.00	0.00
15-21	7	0.28	0.14	0.28	1.00	0.14
22-28	7	0.43	0.00	0.14	1.00	0.00
29-Aug 4	7	1.43	0.00	0.00	1.28	0.14
Aug 5-11	7	0.14	0.00	0.00	2.28	2.14
12-18	7	2.00	0.71	0.14	1.57	3.00
19-25	7	0.50	0.36	0.36	2.00	2.57
26-Sep 1	7	0.50	0.36	0.36	2.00	2.57
Sep 2-8	7	1.57	0.14	0.00	2.71	0.57
9-15	7	1.00	0.00	0.14	2.57	0.14
16-22	7	1.00	0.28	0.00	2.00	0.28
23-29	7	2.57	5.57	1.28	1.43	0.28
30-Oct 6	7	8.71	6.00	1.43	0.71	0.14
Oct 7-13	7	5.00	3.71	1.28	0.57	0.00
14-20	7	1.43	0.28	0.28	0.28	0.00
21-27	7	0.28	0.00	0.28	0.43	0.14

Table 17. Total Number of Adult Mosquitoes taken per Month from the Light Trap at Bayboro, North Carolina, 1973.

Species		April	May	June	July	August	September	October	Seven Month Total
Aedes	taeniorhynchus	0	0	41	42	21	41	107	252
Aedes	sollicitans	0	1	28	12	10	42	71	164
Psorophora	confinnis	0	0	0	2	53	9	2	66
Anopheles	bradleyi	18	11	13	20	6	10	23	101
Culex	spp.	18	41	99	56	47	60	14	335
Total for each month		36	53	181	132	137	162	217	918

Species			Mosquito Abundance (%) Aedes and Psorophora	Anopheles and Culex
Aedes	taeniorhynchus	27.0		
Aedes	sollicitans	18.0		
Psorophora	confinnis	7.0	52	48
Anopheles	bradleyi	11.0		
Culex	spp.	37.0		
Total		100.0		

Table 18. Mean Number of Adults taken per Light Trap Night per week at Oriental, North Carolina, 1973.

Date light trap week	No. of nights light trap in operation	*Aedes taeniorhynchus*	*Aedes sollicitans*	*Anopheles bradleyi*	*Culex* spp.	*Psorophora confinnis*
Apr 15-21	7	0.14	0.14	1.28	1.43	0.00
22-28	7	0.00	0.14	1.14	4.00	0.00
29-May 5	7	0.00	0.14	0.43	0.71	0.00
May 6-12	7	0.00	0.14	0.71	3.57	0.00
13-19	7	0.00	0.14	0.14	3.71	0.00
20-26	7	0.00	1.14	0.14	6.57	0.14
27-Jun 2	7	0.00	0.00	0.00	0.00	0.00
Jun 3-9	7	0.00	1.28	0.14	1.57	0.00
10-16	7	0.28	0.57	0.00	1.71	0.00
17-23	7	0.28	3.30	0.14	2.43	0.00
24-30	7	1.28	3.30	0.14	4.57	0.28
Jul 1-7	7	9.70	6.00	1.00	9.85	0.00
8-14	7	11.70	12.30	7.00	2.71	0.00
15-21	7	3.33	1.70	0.28	4.00	0.71
22-28	7	1.55	0.57	0.00	5.00	0.14
29-Aug 4	7	0.71	0.14	0.00	2.28	0.00
Aug 5-11	7	4.00	1.70	0.57	4.00	0.85
12-18	7	45.70	11.50	0.28	2.71	2.00
19-25	7	30.71	5.60	1.00	2.14	0.71
26-Sep 1	7	30.71	5.60	1.00	2.14	0.71
Sep 2-8	7	18.00	2.70	0.71	3.00	0.43
9-15	7	24.20	4.00	2.57	5.43	1.71
16-22	7	4.00	2.70	4.71	5.71	1.57
23-29	7	16.30	89.40	5.00	4.57	1.57
30-Oct 6	7	45.10	33.10	5.00	2.00	0.00
Oct 7-13	7	16.00	10.40	9.60	2.00	0.00
14-20	7	6.60	3.00	1.00	2.71	0.28
21-27	7	1.57	.43	.71	1.71	0.00

Table 19. Total number of Adult Mosquitoes taken per Month from Light Trap at Oriental, North Carolina, 1973.

Species		April	May	June	July	August	September	October	Seven Month Total
Aedes	taeniorhynchus	1	0	13	188	779	438	486	1905
Aedes	sollicitans	3	10	58	144	173	692	329	1409
Psorophora	confinnis	0	1	2	6	31	30	2	72
Anopheles	bradleyi	18	9	3	57	21	90	113	311
Culex	spp.	40	99	72	160	84	131	59	645
Total for each month		62	119	148	555	1088	1381	989	4342

Species		Mosquito Abundance (%)		
			Aedes and Psorophora	Anopheles and Culex
Aedes	taeniorhynchus	44.0		
Aedes	sollicitans	32.0		
Psorophora	confinnis	2.0	78	22
Anopheles	bradleyi	7.0		
Culex	spp.	15.0		
Total		100.0		

Table 20. Mean Number of Adult Mosquitoes taken per Light Trap Night per week at Florence, North Carolina, 1973.

Date light trap week	No. of nights light trap in operation	Aedes taeniorhynchus	Aedes sollicitans	Anopheles bradleyi	Culex spp.	Psorophora confinnis
May 27-Jun 2	7	0.00	0.00	0.00	0.00	0.00
Jun 3-9	7	0.00	0.00	0.00	0.00	0.00
10-16	7	0.00	0.14	0.00	0.14	0.00
17-23	7	0.00	0.28	0.00	0.00	0.00
24-30	7	0.85	0.28	0.43	1.00	0.00
Jul 1-7	7	17.71	9.85	9.00	0.43	0.00
8-14	7	6.00	4.57	10.00	1.00	0.00
15-21	7	7.00	3.57	6.00	1.57	0.00
22-28	7	4.71	0.43	2.30	2.00	0.00
29-Aug 4	7	7.00	0.00	1.00	0.14	0.00
5-11	7	4.44	0.71	2.00	0.43	0.00
12-18	7	24.00	1.30	1.57	0.28	0.14
19-25	7	11.00	0.14	6.00	0.07	0.07
26-Sep 1	7	11.00	0.14	6.00	0.07	0.07
Sep 2-8	7	1.00	0.28	9.00	0.14	0.00
9-15	7	10.00	2.30	5.71	0.43	0.00
16-22	7	11.00	0.85	3.00	1.43	0.00
23-29	7	46.71	13.57	12.30	0.57	0.00
30-Oct 6	7	38.43	4.71	91.00	1.14	0.00
Oct 7-13	7	63.40	11.00	73.40	1.00	0.00
14-20	7	28.30	3.60	41.10	1.00	0.00
21-27	7	7.70	3.60	13.71	2.28	0.00

Table 21. Total Number of Mosquitoes taken per Month from the Light Trap at Florence, North Carolina, 1973.

Species		June	July	August	September	October	Five Month Total
Aedes	taeniorhynchus	6	280	294	634	814	2028
Aedes	sollicitans	5	129	16	137	141	428
Psorophora	confinnis	0	0	2	0	0	2
Anopheles	bradleyi	3	198	110	323	1422	2056
Culex	spp.	7	36	6	26	28	103
Total for each month		21	643	428	1120	2405	4617

Species			Mosquito Abundance (%)	
			Aedes and Psorophora	Anopheles and Culex
Aedes	taeniorhynchus	43.96		
Aedes	sollicitans	9.00		
Psorophora	confinnis	.04	53	47
Anopheles	bradleyi	45.00		
Culex	spp.	2.00		
Total		100.00		

Table 22. Total Number of Adult Mosquitoes Biting during ten minute interval per half hour at Oriental, North Carolina, 1973.

Date	Time (P.M.) of count	*Aedes taeniorhynchus*	*Aedes sollicitans*	*Anopheles bradleyi*	*Culex* spp.	*Psorophora confinnis*
June 7	8:00- 8:30		1			
	8:30- 9:00					
	9:00- 9:30		1	1	2	
	9:30-10:00					
June 12	8:00- 8:30					
	8:30- 9:00					
	9:00- 9:30					
	9:30-10:00					
June 14	8:00- 8:30					
	8:30- 9:00					
	9:00- 9:30				3	
	9:30-10:00					
June 19	8:00- 8:30	1				
	8:30- 9:00	2				
	9:00- 9:30	5	1		2	
	9:30-10:00					
June 21	8:00- 8:30					
	8:30- 9:00		1			
	9:00- 9:30					
	9:30-10:00					
June 26	8:00- 8:30					
	8:30- 9:00	4				
	9:00- 9:30	13	3		2	1
	9:30-10:00	4			2	
June 28	8:00- 8:30		1			
	8:30- 9:00	1				
	9:00- 9:30	6	3			
	9:30-10:00	2			1	

Table 22. (Continued)

Date	Time (P.M.) of count	Aedes taeniorhynchus	Aedes sollicitans	Anopheles bradleyi	Culex spp.	Psorophora confinnis
July 3	8:00- 8:30	2				
	8:30- 9:00	1				
	9:00- 9:30	7	3		2	
	9:30-10:00	4				
July 11	8:00- 8:30	4				
	8:30- 9:00	1				
	9:00- 9:30	32	8		1	
	9:30-10:00	6	2			
July 16	8:00- 8:30	1				
	8:30- 9:00	1	1			
	9:00- 9:30	4				
	9:30-10:00					
July 18	8:00- 8:30	1				
	8:30- 9:00	6			1	
	9:00- 9:30	10			6	1
	9:30-10:00	3			1	
July 23	8:00- 8:30					
	8:30- 9:00	9	1		1	
	9:00- 9:30	2				
	9:30-10:00					
Aug 1	8:00- 8:30					
	8:30- 9:00					
	9:00- 9:30					
	9:30-10:00					
Aug 6	8:00- 8:30		1			
	8:30- 9:00	10			2	
	9:00- 9:30	2			1	
	9:30-10:00					

Table 22 (Continued)

Date	Time (P.M.) of count	Aedes taeniorhynchus	Aedes sollicitans	Anopheles bradleyi	Culex spp.	Psorophora confinnis
Aug 8	8:00- 8:30	4				
	8:30- 9:00	21	1		2	
	9:00- 9:30	5	1			
	9:30-10:00	3	1			
Aug 13	8:00- 8:30	68	5			
	8:30- 9:00	25	3			
	9:00- 9:30	30	4			
	9:30-10:00	18	5			
Aug 15	8:00- 8:30	27	1			
	8:30- 9:00	30	8			
	9:00- 9:30	12	1			
	9:30-10:00	7	1			
Aug 29	8:00- 8:30	50	8			2
	8:30- 9:00	18	3			
	9:00- 9:30	6	3			
	9:30-10:00	4	1			
Sep 3	7:30- 8:00	34	1			1
	8:00- 8:30	34	4			1
	8:30- 9:00	5	1			
	9:00- 9:30	6	1	1		
Sep 5	7:30- 8:00	20	3			
	8:00- 8:30	24	2			
	8:30- 9:00	6				
	9:00- 9:30	3	1			
Sep 11	7:30- 8:00	37	4			
	8:00- 8:30	10	4			
	8:30- 9:00	5	1			
	9:00- 9:30	2				

Table 22. (Continued)

Date	Time (P.M.) of count	Aedes taeniorhynchus	Aedes sollicitans	Anopheles bradleyi	Culex spp.	Psorophora confinnis
Sep 13	7:30- 8:00	15		1	2	
	8:00- 8:30	2	1			
	8:30- 9:00					
	9:00- 9:30					
Sep 18	7:00- 7:30	6	2			
	7:30- 8:00	5	4	1	1	1
	8:00- 8:30	2	1			
	8:30- 9:00	1				
Sep 24	6:30- 7:00	3				
	7:00- 7:30	4	1			
	7:30- 8:00	32	8			
	8:00- 8:30	2				
Sep 26	7:00- 7:30	56	26			
	7:30- 8:00	35	14		1	
	8:00- 8:30	10	6			
Oct 1	7:00- 7:30	46	22			
	7:30- 8:00	42	12	1		
	8:00- 8:30	20	8	2		

Table 23. Total Number of Adult Mosquitoes taken per Month during Biting Counts at Oriental, North Carolina, 1973.

Species		June	July	August	September	October	Five Month Total
Aedes	taeniorhynchus	38	94	340	359	108	939
Aedes	sollicitans	11	15	47	85	42	200
Anopheles	bradleyi	1	0	0	3	3	7
Culex	spp.	12	12	5	4	0	33
Psorophora	confinnis	1	1	3	3	0	8
Total for each month		63	122	395	454	153	1187

Species			Mosquito Abundance (%)	
			Aedes and Psorophora	Anopheles and Culex
Aedes	taeniorhynchus	79.1		
Aedes	sollicitans	16.8		
Anopheles	bradleyi	00.6	96.5	3.5
Culex	spp.	2.9		
Psorophora	confinnis	00.6		
Total		100.0		