

ARTICLES

SPECIES COMPOSITION OF MOSQUITOES PRODUCED
IN DREDGED MATERIAL, WILDLIFE MANAGEMENT,
AND NATURAL SALTMARSH HABITATS OF THE
SOUTH CAROLINA COAST¹JOSEPH VORGETTS, JR.,² WM. BRUCE EZELL, JR.³ AND JAMES D. CAMPBELL⁴

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ABSTRACT. Mosquito breeding in coastal South Carolina was surveyed during 1977 with emergence traps. A total of 27,362 mosquitoes was collected. The dominant species collected was *Aedes taeniorhynchus* which outnumbered the second major species, *Ae. sollicitans*, by a

factor of approximately 5 to 1. The relative abundance of these 2 species was more than 8 times higher in trap collections made from dredged material disposal sites and waterfowl management areas that were diked as opposed to unmodified saltmarsh habitats.

INTRODUCTION

The association of mosquito breeding within hydraulic spoil areas was probably first described by Gorgas (1915) from a site resulting from dredging of the Panama Canal. Since that time, reports linking mosquito breeding with the disposal of dredged material have been scattered and incomplete. (Brooks 1939, Thom 1942, 1955, Vannote 1955). A thorough review of this subject has been provided by Ezell (1978) and Vorgetts and Ezell (1978). More recently, Scotton and Axtell (1979) studied the oviposition habits of two saltmarsh mosquito species on dredged spoils in North Carolina.

The mosquito nuisance problems resulting from dredging activities are particularly acute in coastal South Carolina because the Atlantic Intra-coastal Waterway requires frequent maintenance dredging. In addition, siltation in the ports of Charleston and Georgetown, SC, is a chronic problem which requires nearly continuous dredging. The problem is intensified because the disposal sites or hydraulic "spoil" areas often are within or contiguous with major population centers. The U. S. Army Corps of Engineers, Charleston District, currently defrays costs associated with the abatement of mosquito-related problems within South Carolina disposal sites. These control efforts include ground applications of larvicides and aerial applications of adulticides. The cost of these operations was in excess of \$100,000 during the 1978 season alone (Personal Comm. from L. A. Williams, Director, Div. of Vector Control, S. C. Dept. of Health and Environmental Control, Columbia, S. C.).

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Because of the high cost of temporary control, studies have also been sponsored by the Charleston District of the Corps of Engineers to develop less costly source reduction procedures for dredged material disposal areas. The development of such procedures requires a thorough documentation of the mosquito species

which must be eliminated. O'Meara (1976), Ferrigno et al. (1969) and Provost (1977) have described some types of saltmarsh mosquito breeding habitats. However, little published information is available concerning the species composition or relative intensity of mosquito breeding within South Carolina disposal areas when compared with other coastal habitats of the state. The results of a study to acquire this information are the subject of this report.

MATERIALS AND METHODS

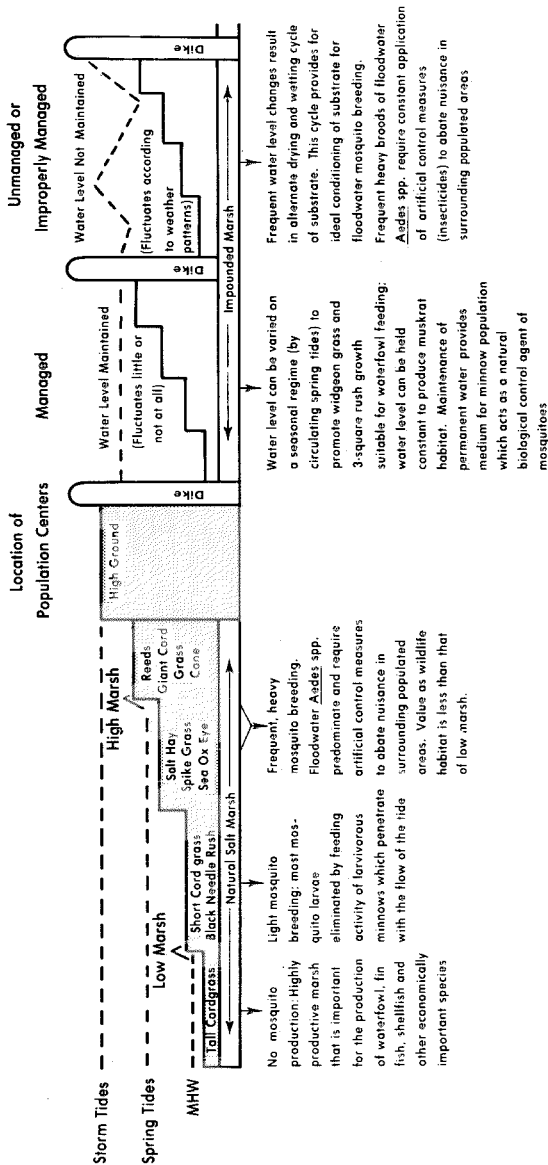
Three saltmarsh habitats representing a cross section of South Carolina coastal wetlands were surveyed with emergence traps. They included (1) dredged material disposal areas, (2) waterfowl management impoundments (referred to as "duck ponds" in South Carolina), and (3) natural high saltmarsh locations. Habitat types (1) and (2) represented areas of saltmarsh that were enclosed by dikes so that the natural drainage patterns were interrupted. Habitat type (3), natural high marsh, represented saltmarsh that had never been deliberately modified by man. A schematic diagram illustrating the relationship of the 3 habitat types surveyed, as they occur in South Carolina, is shown in Figure 1. Dredged material disposal areas correspond to unmanaged impounded marsh in the Figure. The unmodified, natural saltmarsh sampling sites were all located on high marsh associated with barrier beach islands. The criteria used to distinguish high marsh were based on descriptions of plant species associations for high marsh in North Carolina reported by Adams (1963). These high saltmarsh species included *Spartina patens*, *Distichlis spicata*, *Borrichia frutescens*, *Fimbristylis castanea*, and *Aster tenuifolius*.

Each emergence trap consisted of a wood frame which formed four panels that were covered with 18-mesh nylon screen. The panels were sloped toward the top to accommodate a plywood platform used for securing removable col-

lecting containers. The collecting containers were fashioned from 1 quart polyethylene ice cream containers by cutting a hole in the bottom of each container and gluing a polyethylene funnel (in the inverted position) over the hole. A trap and collecting container are illustrated in Figure 2. The base of each trap covered 1 m². Fifteen sampling stations were located in dredged material disposal areas, 5 were established on natural high marsh and 3 were located in duck ponds. More sampling stations were located in dredged material disposal areas than in the other habitats because disposal areas exhibit a number of different subhabitats (Ezell 1978); while the other habitats were homogeneous. An effort was made to establish at least 1 sampling location representing each type of habitat studied in each of the 3 geographical areas included in the survey: Charleston, Georgetown, and Beaufort-Colleton counties. Collections were removed from each trap once or twice per week from 30 June-28 September 1977. Traps were relocated each week to sample a previously unsampled portion of the same substrate type within each study location. Rain gauges were located at each sampling station and a record of surface water depth was maintained for each location.

RESULTS AND DISCUSSION

The level of floodwater mosquito breeding observed in coastal South Carolina during early summer of 1977 was lower than usual because of lower than average rainfall during this period. Rainfall was 3 inches or more below normal in June, 1977, and 4 inches or more below normal in July, 1977, at all sampling stations. Rainfall was heaviest during the last 6 weeks of the survey and this was also the period when mosquito collections in emergence traps reached a peak. The dominant species recorded at all 3 habitat types during the summer of 1977 was *Aedes taeniorhynchus* (see Table 1). *Ae. sollicitans* was present as a 2nd



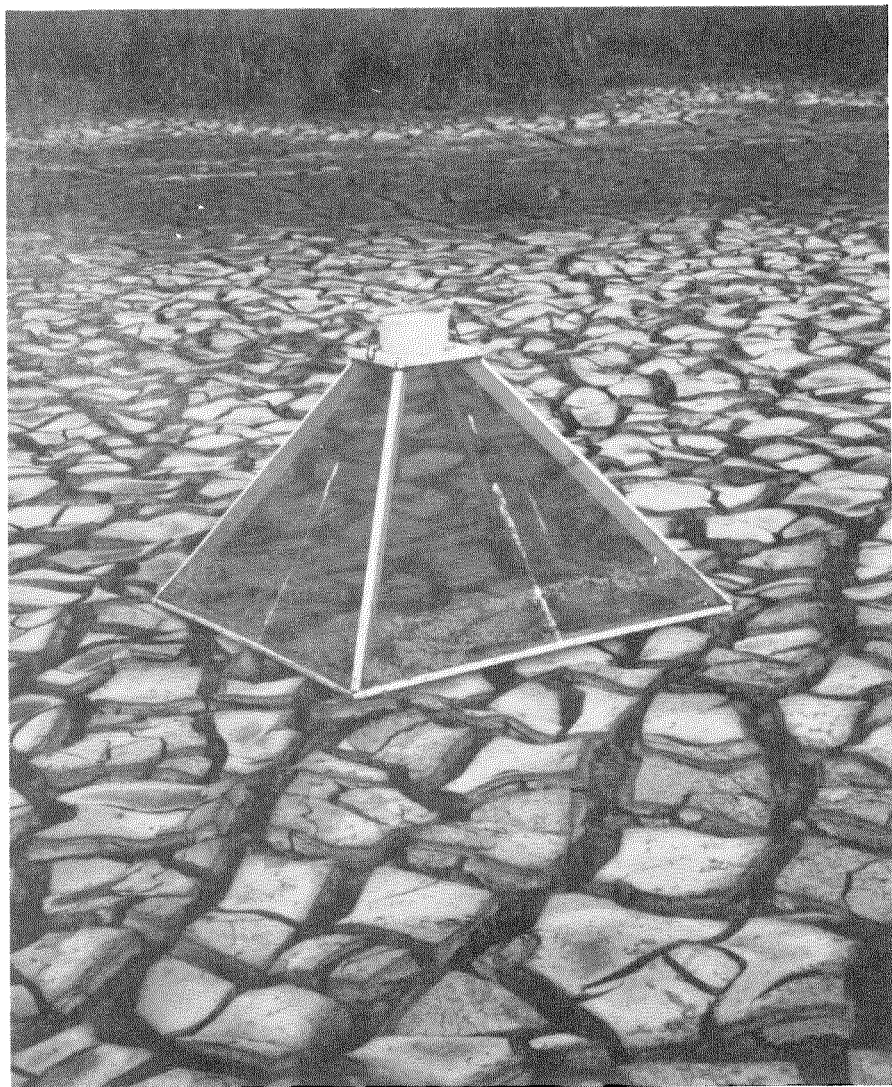


Table 1. Average number of mosquitoes collected per trap from 3 saltmarsh habitat types in S.C. in 1977.

Species	Type of Habitat		
	DMDA ¹	NM ²	DP ³
<i>Aedes taeniorhynchus</i> (Wiedemann)	1,248	172	1,256
<i>Aedes sollicitans</i> (Walker)	198	6	259
<i>Anopheles bradleyi</i> King	9	1	11
<i>Culex salinarius</i> Coquillett	3	0	4
<i>Aedes mitchellae</i> (Dyar)	0	>1	0
<i>Psorophora columbiae</i> Dyar and Knab	0	>1	0

¹ DMDA = Dredged Material Disposal Area (n = 15).

² NM = Natural Marsh (n = 5).

³ DP = Duck Pond or Waterfowl Management Site (n = 3).

major species but was exceeded by *Ae. taeniorhynchus* by approximately 5-1.

When weekly emergence trap records were reviewed, a pattern of nearly constant emergence of small numbers of mosquitoes in the range of 10-20 per m² of sampling area was noted for the natural high marsh sites. In contrast, mosquito emergence from the dredged material disposal sites and duck ponds occurred in the form of fewer but very large broods on a regular basis after each significant rainfall flooded the eggs associated with the fissured soil habitat. The permanent pool breeding mosquitoes, *Anopheles bradleyi* and *Culex salinarius*, were collected from all sites with fissured substrates that retained water for long periods of time. At one dredged material disposal site station, emergence of *An. bradleyi* was recorded along with *Ae. taeniorhynchus* and *Ae. sollicitans*.

We were especially interested to note on several occasions the presence of large numbers of mosquito larvae developing within disposal sites devoid of vascular plant life. In other locations, we observed equally large numbers of larvae developing within fissured soil in close association

with mats of vegetation similar to conditions described by Scotton and Axtell (1979). These authors reported that significantly higher numbers of mosquito eggs were found in association with the exposed surfaces of *Aster subulatus* than with any of the other habitats that they sampled in North Carolina. Further studies are needed to elucidate the niche partitioning mechanisms affecting mosquito populations within dredged material disposal sites.

CONCLUDING REMARKS

Emergence traps were used over suspected mosquito breeding habitats in diked dredged material disposal areas, coastal duck ponds, and natural high saltmarsh. In general, a steady pattern of emergence was observed from the high marsh locations; while a more striking brood pattern appeared from the duck ponds and disposal areas. Significant numbers of larvae of *Ae. taeniorhynchus* and *Ae. sollicitans* were observed to develop within dredged material disposal sites that were devoid of vegetation. All stations that held water for extended periods of time were observed to develop small populations of *An. bradleyi* and *Cx. salinarius*.

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TOXORHYNCHITES RUTILUS RUTILUS: EFFECT OF SHIPMENT BY COMMERCIAL AIR CARRIER ON ADULTS

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ABSTRACT. A technique is described for shipping adult *Toxorhynchites rutilus rutilus* by commercial air carrier to allow the production of this mosquito predator at a site distant from the release site. Indoor and field evaluations of

In evaluations of using *Toxorhynchites rutilus rutilus* (Coquillett) as a biological control agent against *Aedes aegypti* (L.) and other mosquitoes that breed in artificial containers, we shipped laboratory-reared *Tx. r. rutilus* adults from Gainesville, Florida, to New Orleans, Louisiana, by commercial air carrier for release at a test site. Females from several such shipments produced fewer eggs than did unshipped

the shipping procedure indicated that the technique temporarily increases fecundity but reduces overall adult daily survival and total oviposition.

females in earlier experiments (Focks et al. 1978). Because of our interest in the ability to produce adult predators at a central location and ship them quickly to distant release sites and the fact that concurrent quality control tests in the laboratory did not fully assess the extent of the deleterious effects of such air transport, we conducted this field study to evaluate the effects of shipping