SUMMARY. First observations on a population of *C. tarsalis* in a state of true hibernation in a natural site (loose rock at bases of volcanic outcrops) in the Columbia Basin are reported.

Circumstantial evidence is presented that *C. tarsalis* is not *the* mechanism for maintenance of encephalitis viruses through the severe winters of northern climates.

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MOSQUITOES IN SEWAGE STABILIZATION PONDS IN THE DAKOTAS

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During recent years, the use of stabilization ponds as a method of sewage treatment has grown rapidly in popularity throughout the country. This growing popularity has been especially pronounced in the Dakotas and other states in the Missouri River Basin. Although the use of stabilization ponds is an accepted method of treating sewage in the Northern Plains area, some concern has been expressed relative to the possible public health hazard of these ponds from the standpoint of mosquito potential.

To evaluate the mosquito potential of sewage stabilization ponds, a special field survey was carried out in the Dakotas during the period July 30–August 8, 1956. Participating in this survey were representatives from the Robert A. Taft Engineering Center and the Communicable Disease Center of the U. S. Public Health Service. In addition, one of the district engineers of the South Dakota Department of Health assisted in the inspection of three installations in the southwestern portion of the state.

Of the 26 stabilization ponds studied, 14 were located in South Dakota and 12 in North Dakota. These facilities represented about 35 percent of all the waste stabilization ponds in the Dakotas. The territory inspected included each of the four geographic sections of the two states and included both the northern Great Plains and Central Lowland physiographic provinces. The ponds varied in age from less than 1 year to 8 years and in size from 1 to 135 acres.

The procedure used in sampling was to dip around the pond margins, the number of dips at each facility ranging from 25 to 200. In a few of the shallow ponds that contained weed growth throughout, the inspection was not limited to the marginal areas. Observations were made on the relative amount of vegetation in each pond. The results of the survey are summarized in table 1. The basis for classifying the vegetation was as follows: If the pond were free of both emergent aquatic plants and terrestrial vegetation, it was classified as *none* (fig. 1); if the vegetation were sparse, *light* (fig. 2); and if abundant, *heavy* (figs. 3, 4, 5, and 6). Mosquito production was classified as: *negative* if no larvae or pupae were found; as *light*, if most of the dips were negative; as *moderate*, if many were positive; and *heavy*, if virtually every dip contained larvae or pupae.

Eighteen of the ponds (69 percent) were found to be positive for *Culex tarsalis*, the common encephalitis mosquito of the western states. Of the positive ponds, mosquito production was classified as light in 8, moderate in 2, and heavy in 8. Over 99 percent of all the mosquitoes collected (735 specimens) were *C. tarsalis*. Other species collected were 2 specimens each of

TABLE 1.—Summary of entomologic inspections at sewage stabilization ponds in South Dakota and North Dakota, July 30–August 8, 1956

State	Place	Marginal Vegetation	No. of Dips	Mosquito Production
South Dakota	Wall	Heavy	150	Moderate
" "	Philip	Heavy	75	Heavy
" "	Kadoka	Light	60	Light
" "	Burke	Light	95	Negative
" "	Freeman	Heavy *	65	Heavy
" "	Beresford	Light	150	Light
" "	Sioux Falls	Heavy	85	Light
" "	Redfield	Heavy *	70	Heavy
" "	Isabel	None	25	Negative
" "	Bison	Light	35	Negative
" "	Lemmon	Light	140	Negative
" "	Veblen	Heavy	50	Moderate
" "	New Effington	Heavy *	30	Heavy
" "	Sisseton	None	30	Negative
North Dakota	Assumption Abbey	None	35	Negative
" "	Elgin	Heavy	165	Heavy
" "	Dunn Center	Light	120	Light
" "	Watford City	Heavy *	100	Heavy
" "	New Town	Heavy	100	Light
" "	Flaxton	Heavy *	70	Heavy
" "	Rolla	None	25	Negative
" "	Maddock	Heavy	200	Light
" "	Larimore	Heavy	80	Heavy
" "	Portland	Light	60	Negative
" "	Jamestown	Light	130	Light
" "	Wishek	Heavy	80	Light

* Weed growth throughout pond.

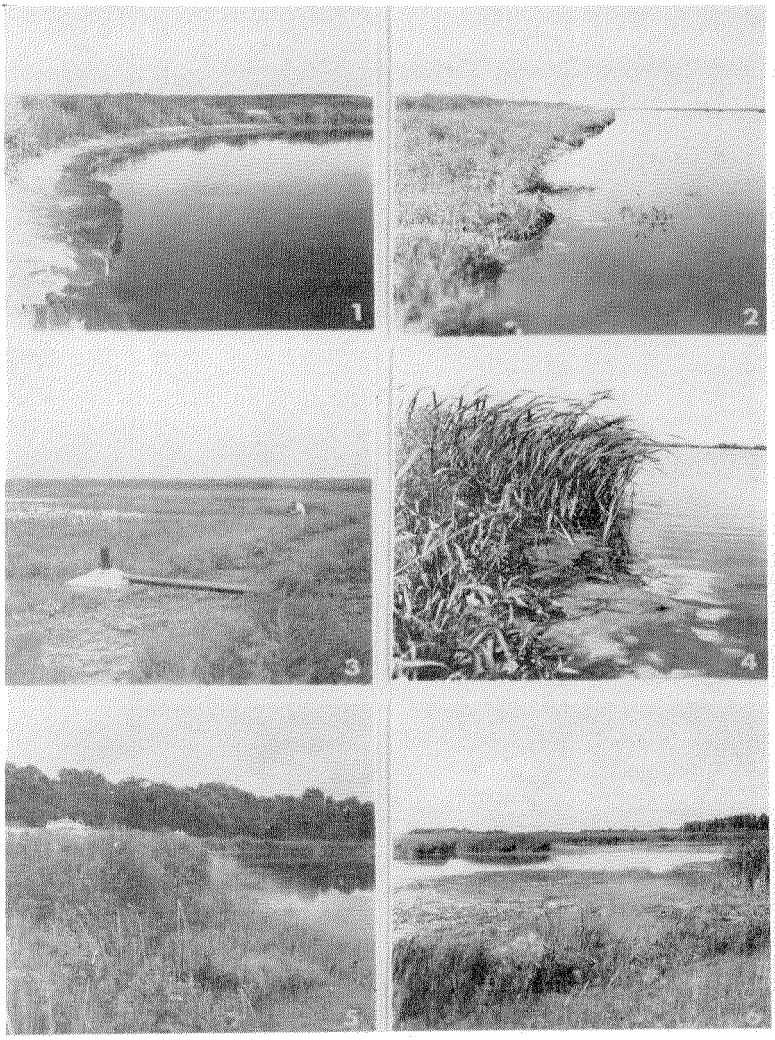

FIG. 1.—Stabilization pond with no vegetation.
FIG. 2.—Pond with light vegetation along margin.
FIG. 3.—Pond, with terrestrial plants, in the process of filling.
FIG. 4.—Emergent aquatic plants along shore of pond.
FIG. 5.—Heavy growth of terrestrial weeds along pond margin.
FIG. 6.—Heavy growth of aquatic plants throughout pond.

Aedes campestris, *Aedes dorsalis*, and *Culex restuans*.

In all cases where mosquito production was found, vegetation (terrestrial and/or aquatic) was present. In general, the shallowest ponds contained the most vegetation. Mosquito breeding was observed under three types of situations, *viz*, (1) when the ponds were being filled but had not reached operating depth and contained terrestrial and emergent or submerged aquatic plants (fig. 3); (2) when terrestrial plants along the shore extended or hung into the water (fig. 5); and (3) when submerged and/or emergent aquatic plants grew along the shore or elsewhere in the pond (figs. 4 and 6). Production of mosquitoes was found to be negative or of little consequence when weed growth was absent or minimal (figs. 1 and 2).

From the results of the survey, it may be concluded that most sewage stabilization ponds with vegetation have a high *C. tarsalis* production potential, but without vegetation, a low mosquito potential.

RECOMMENDATIONS FOR MOSQUITO CONTROL. To minimize or eliminate mosquito breeding in sewage stabilization ponds, it is essential that weed growth be prevented or controlled. This can be accomplished by proper design and operation of the installations.

In the basic design of the pond, it is recommended: (1) that provision be made for a minimum depth of 4 feet of water during the mosquito breeding season; (2) that provision be made for relatively steep embankment slopes—*e.g.*, 1 foot vertical to 4 feet horizontal; and (3) that access be provided so that insecticiding operations may be carried out, if necessary.

In the operation and maintenance of the facility, it is desirable to: (1) provide for rapid filling of the pond; (2) eliminate vegetative growth—both emergent aquatics and overhanging terrestrial plants—by mechanical measures or by the use of suitable herbicides; and (3) utilize larvicides as necessary. Satisfactory larvicidal formulations are: diesel oil (thin layer), 1 or 2 percent oil solution of DDT, or BHC dust (3 percent gamma isomer).

SUMMARY. A survey in 25 counties in South Dakota and North Dakota was conducted to determine whether or not sewage stabilization ponds are an important source of mosquitoes. Of 26 ponds inspected, no larvae were found in 8. *C. tarsalis* was recovered from the remaining 18, mosquito production being classified as light in 8, moderate in 2, and heavy in 8. Over 99 percent of the mosquitoes collected were *C. tarsalis*. In all cases where mosquito production was found, vegetation (terrestrial or aquatic) was present. Mosquito production was negative or of little consequence when weed growth was absent or minimal. Therefore, it was concluded that stabilization ponds with vegetation had a high *C. tarsalis* production potential, and those without vegetation, a low mosquito potential.