THE UNIVERSITY OF MANITOBA

AN ECOLOGICAL STUDY OF MOSQUITOES IN THE AREA OF PINAWA, MANITOBA, WITH SPECIAL REFERENCE TO THE DISTRIBUTION AND ABUNDANCE OF THE GENUS AEDES

by

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ABSTRACT

In Winnipeg, the developmental sites of pest mosquito larvae are localized and in close proximity to potential hosts. This discovery motivated a study of the distribution and abundance of both larval and adult mosquitoes at Pinawa, Manitoba. If pest mosquito developmental sites were found to be localized and predictable, source reduction of pest mosquitoes, the control method being developed in Winnipeg, might be applicable.

At Pinawa, the density of mosquito larvae generally increased with increases in the amount of vegetative cover. During the 1971 season almost all mosquito production took place in the early spring and was the greatest per unit area in the most densely vegetated areas. Certain species of mosquito larvae were associated with areas of particular degrees of vegetative cover.

Studies of adult mosquitoes revealed that as the amount of vegetative cover increased, the numbers of mosquitoes captured in CO_2-baited traps also increased. Some mosquito species were associated with open areas and others with wooded habitats. Collecting mosquitoes as they attempted to feed on man in a recreational area of Pinawa showed that pest mosquito abundance was greatest in the early spring when *Aedes abserratus*, *Aedes intrudens*, *Aedes communis*, and *Aedes punctor* were most

abundant. _Aedes implicatus_ comprised large proportions of spring mosquito larvae populations in almost all areas examined but it was not taken attempting to feed on man during 1971.

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Chapter I

INTRODUCTION

(i) Motivation for the investigation

In a study of the ecology of mosquito larvae in the Winnipeg area, Dixon (1969) found that the developmental sites of pest mosquito larvae are localized and in close proximity to the source of a blood meal. In most cases this blood source is a concentration of domestic animals. Horsfall (1942), when studing the biology and control of a rice field mosquito, found that fields over which livestock had grazed are outstandingly high in larval abundance, whereas those over which livestock had not been grazed have few or no larvae present.

Knowing that the developmental sites of pest mosquitoes are found in association with potential host animals, mosquito control operations may direct their effort at these areas rather than search over large areas where mosquito larvae may be rare or absent. In addition, such localized mosquito production provides a case against widespread application of insecticides that merely contribute to pollution of the environment.

If such localized mosquito production also occurs in non-agricultural, woodland areas, and the location of larval mosquito developmental sites is predictable, a strategy of mosquito control similar to that described above could be adopted. In such woodland areas, where the economy may be based on logging, mining and hydro-electricity generation rather than on cereal crop and livestock, much less is known about the distribution of potential host animals. Therefore, some other measurable environmental variable must be used to systematically study the distribution and abundance of mosquito larvae.

Shemanchuk (1959), when studying mosquito production in irrigated areas of southern Alberta, compared mosquito productivity on the basis of farming practices, which varied in the efficiency of drainage systems and in the length of time since the practice of irrigation was initiated.

Happold (1965a), in a study of the ecology of woodland mosquitoes in central Alberta, compared the productivity of mosquito larvae developmental sites differing in position, permanence, and the amount of shading by plants.

In the present study, little is known about potential mosquito host distribution, although large differences in the amount and type of vegetative cover exist among different areas. It was proposed that the abundance of mosquito larvae be compared among such areas. If consistently high mosquito larvae abundance was found to be associated with areas of particular vegetative cover and type, the control of mosquito larvae would become feasible where it was previously thought impractical due to assumed uniform, widespread mosquito production.

In addition to a knowledge of mosquito larvae distribution and abundance, information concerning the distribution and abundance of adult mosquitoes is also useful in planning mosquito control measures. If adult mosquitoes are found to be more abundant in certain areas with a particular type and amount of vegetative cover, control directed at such sites will be more effective than control which is widespread and which may be applied to areas where adult mosquito densities are low.

Identification of the pest mosquito species of utmost importance. Knowing the distribution and abundance of the larvae and adults of the pest mosquito species, control measures may be restricted to these, thereby neglecting other species which may be very abundant but of no importance as a pest.

(ii) Objectives of the investigation

The aims of the study were:

i) to compare the abundance of larval and adult mosquitoes in areas differing in the amount and type of vegetative cover and to determine if associations exist between particular mosquito species and certain areas.

ii) to determine which species are the most important as pest mosquitoes within recreational areas of the town of Pinawa, Manitoba.

Chapter II

DESCRIPTION OF THE STUDY AREA

For the most part, information presented in this description was taken from Weir (1960), although some observations were made during the time in which the inv tigation was in progress.

The study was carried out in a woodland region of south-eastern Manitoba which lies on the south-western edge of the pre-cambrian shield (Fig. 1). The area is situated in a narrow band of mixed deciduous and coniferous woods bordered on the north by the boreal forest and to the east by wooded grassland. Forty percent of the area is covered by bogs and lakes.

Within the study area, the Whiteshell Nuclear Research Establishment comprises almost the total economy although in surrounding areas it is based on logging, hydro-electricity generation and livestock production.

Although livestock are not found within the study area, a variety of other animals may serve as potential mosquito hosts. Waterfowl and upland game birds such as the sharp-tailed grouse (*Pedioecetes phasianellus*), spruce grouse (*Canachites canadensis*) and ruffed grouse (*Bonasa umbellus*) occur in relatively light densities throughout the study area whereas the moose (Alces americana andersoni), black bear (Euarctos americanus) and white-tailed deer (Odocoileus virginianus) are found in relatively high density. Other potential host animals occuring in the study area are the beaver (Castor canadensis), muskrat (Ondatra zibethica), fisher (Martes pennanti), lynx (Lynx canadensis), bobcat (Lynx rufus), coyote (Canis latrans) and numerous species of small mammals and birds. On 24 June, 1971, mosquitoes (probably Aedes vexans) were observed attempting to feed on the cottontail rabbit (Sylvilagus floridanus).

Weather conditions are characterized by a large annual range of temperature with the average (based on the 30 year period 1921-1950) in June being 60° F, July 66° F and January - 5° F. Average precipitation (based on the 30 year period 1921-1950) is 21 inches, with that of May, June and July being 7 inches and snowfall being an average of 50 inches.

Within the study area, mosquito abatement operations are limited to the town of Pinawa, where insecticide fogging is used in an attempt to control adult mosquitoes. During the spring and summer of 1971, those areas producing mosquito larvae within the town itself were larvicided for the first time.

Chapter III

MANITOBA MOSQUITOES AND A SYNOPSIS OF THEIR BIOLOGIES

Forty-five species of mosquitoes, distributed among six genera, have been recorded form Manitoba (Table I). Thirty-one of these species were found to occur within the study area, *Aedes trivittatus* and *Culiseta minnesotae* were recorded for the first time in Manitoba.

The life cycle of mosquitoes, involving a complete metamorphosis, is represented by four distinct stages, ie: from the egg hatches a larva, which transforms into a pupa from which the winged adult later emerges. The larvae and pupae of all species are aquatic, being found in standing and slowly moving water.

Depending on the overwintering stage, three types of mosquito life cycles are recognized in Manitoba. Mosquitoes of the genus *Anopheles*, *Culex* and *Culiseta* overwinter as adults. Inseminated females hiberinate in dark protected places such as caves and hollow trees, emerging in the early spring to feed and deposit eggs. There may be more than one generation per year.

The genus *Mansonia* and *Wyeomyia* overwinter in the larval stage. Development resumes as a response to increases in daylength and temperature in *Wyeomyia smithii* at least, and adults appear in late spring to

Table I

List of mosquitoes recorded from Manitoba

Aedes abserratus 1*[a]	Anopheles earlei 4*
aurifer 6	punctipennis 6
barri 1*	walkeri 6*
campestris 6	
canadensis 6*	
cataphylla 5	
cinereus 6*	
communis 6*	Culex apicalis 6
decticus 1	pipiens 6
diantaeus 2*	restuans 6*
dorsalis 6*	tarsalis 6*
excrucians 6*	territans 3*
fitchii 6*	
flavescens 6*	
hexodontus 2	
impiger 2	
implicatus 7*	Culiseta alaskaensis 6
intrudens 6*	impatiens 6
nigripes 6	inornata 6*
nigromaculus 6	morsitans 6*
pionips 6*	minnesotae X*[b]
punctor 6*	
riparius 6*	
spencerii 6*	
sticticus 6*	
stimulans 6*	Mansonia perturbans 6*
trichurus 6*	
triseriatus 1	
trivittatus X*[b]	
vexans 6*	Wyeomyia smithii 6*

[a] Source of record: 1, Brust and Kalpage (1967); 2, Freeman (1952); 3, McLintock (1944); 4, McLintock and Rempel (1963); 5, Stone et al. (1965); 6, Twinn (1949); Vockeroth (1954a).

[b] = new record

* = species found to occur at Pinawa, Manitoba

early summer. *Mansonia perturbans* oviposits on the water surface of marshes and *Wyeomyia smithii* deposits eggs within the leaf of the pitcher plant, *Sarracenia purpurea*. The bionomics of this species has been studied by Evans (1971).

In terms of numbers and human annoyance, mosquitoes of the genus *Aedes* are the most important in Manitoba. Overwintering occurs in the egg stage. These eggs, deposited during the spring and summer on moist debris above the water line in drying pools of water, hatch when flooded by melting snow and spring and summer rains.

Aedes mosquitoes exhibit two general bionomic patterns. One group of species has but a single generation per year (univoltine) while another smaller group may have a number of generations per year (multivoltine) (Table II). *Aedes campestris*, *Aedes canadensis*, *Aedes cinereus* and *Aedes spencerii*, generally regarded univoltine, are partly multivoltine (Brust, 1968).

Both univoltine and multivoltine *Aedes* emerge in the spring, mate, feed and oviposit. Eggs laid by univoltine species enter an obligatory diapause, not hatching until the following spring despite repeated inundation during the spring and summer months. Eggs laid by multivoltine species hatch after inundation, with the result that a brood of mosquitoes may develop in pools formed after each summer rain.

Oviposition behaviour controls the distribution

Table II

Bionomic classification of Aedes mosquitoes

Univoltine species

Aedes abserratus	Aedes diantaeus	Aedes nigripes
Aedes aurifer	Aedes excrucians	Aedes pionips
Aedes barri	Aedes fitchii	Aedes punctor
Aedes canadensis	Aedes flavescens	Aedes riparius
Aedes cataphylla	Aedes hexodontus	Aedes spencerii
Aedes cinereus	Aedes impiger	Aedes sticticus
Aedes communis	Aedes implicatus	Aedes stimulans
Aedes decticus	Aedes intrudens	Aedes trichurus

Multivoltine species

Aedes campestris	Aedes nigromaculus	Aedes trivittatus
Aedes dorsalis	Aedes triseriatus	Aedes vexans

of mosquito larvae. It may be influenced by a number of factors. Good sites for oviposition by *Aedes* mosquitoes are the moist margins of pools that are exposed as the water table falls. Other factors favourable to ovipositing *Aedes* females are a substrate of plant detritus and protection from wind and direct sunlight (Horsfall, 1963).

Chapter IV

HABITAT CLASSIFICATION FOR LARVAE OF *AEDES* MOSQUITOES

Mosquito larvae are found in temporary, semi-permanent, and permanent bodies of standing water. Temporary pools contain water for periods usually not exceeding three weeks; semi-permanent pools contain water almost all spring and summer; and permanent pools contain water during the entire year.

The hords of pest mosquitoes appearing throughout the Canadian prairie and woodland during late May and June belong to the genus *Aedes* (Rempel, 1953). The larvae are found only in temporary and semi-permanent pools resulting from snow melt and rain (Happold, 1965a). This study is concerned with the distribution of abundance of these species in different habitats.

Although many mosquito habitat classifications have been described, few have been devised to serve as a basis for studying the relative abundance of *Aedes* mosquitoes in a woodland terrain. In the present study, the system of habitat classification is based on the dominant plant present. Associated with the various changes in plant dominance are changes in the type (temporary or semi-permanent), number, size and shape of pools; changes in the physical structure of the plant community; and the degree of shading by plants.

Five easily recognized, distinct habitat types are defined. Each successive habitat type shows an increase in the amount of vegetative cover. Vegetative cover shelters mosquitoes from excess light, dryness and wind thus providing a situation favourable to oviposition by Aedes mosquitoes (Horsfall, 1963).

When describing pools in each habitat type, those termed small range in size from 1 - 5 square meters in surface area, medium sized pools from 6 - 25 square meters and extensive pools include those greater than 25 square meters in surface area.

The five habitat types are:

1. Disturbed habitat:

Abandoned farmer's fields, clearings for hydro-electricity transmission lines, surveyer's line cuts, roadside ditches and other open, treeless areas resulting form man's disturbance or fire are examples of the disturbed habitat type. Such sites are uncommon in the study area except in the land surrounding and within the Whiteshell Nuclear Research Establishment and the town of Pinawa.

As a result of vehicular traffic, fire or soil removal, the topography of the disturbed habitat is in many cases irregular, with pools usually abundant and ranging in size from long narrow tire ruts (Fig. 2) to larger areas where topsoil has been removed or where ditches have been constructed (Fig. 3).

Spring pools, flooded by melting snow, are lined with decaying grass and weeds from the preceeding summer's growth. Due to the openess, spring sun and wind may rapidly dry the more shallow pools which in many cases will kill developing larvae. With the removal of topsoil and subsequent exposure of non-porous clay, pools may be flooded by spring and summer rains and produce a brood of multivoltine _Aedes_ mosquitoes. The porous topsoil in other habitat types quickly absorbs large amounts of rain, allowing no pools to form.

In the summer, the disturbed habitat exhibits a growth of herbaceous plants which may reach as much as one meter in height. Those sites where water persists for longer periods, as for example ditches and borrow pits, usually have some emergent vegetation (Fig. 4) whereas those sites where pools dry rapidly have only a growth of grasses and weeds (Fig. 5).

2. Early regeneration habitat:

The occurrence of tree growth in a disturbed habitat gives rise to the early regeneration habitat. Small tracts of this habitat type were found scattered throught the area. Pools are not abundant, but where they occur they consist of shallow to deep grass lined depressions of various sizes (Fig. 6).

In summer, the early regeneration habitat is characterized by open areas of tall grass reaching one meter in height with scattered shrub growth islands consisting of willow (_Salix_ sp.), birch (_Betula_ sp.), alder (Alnus sp.), poplar (Populus sp.) and dogwood (Cornus sp.) (Fig. 7). The presence of these trees affords shade and wind protection to some areas which will flood the following spring.

3. Poplar-ash habitat:

The poplar-ash habitat type has greater vegetative cover than the early regeneration habitat. Poplar habitats may consist of young stands of aspen (Populus sp.), usually not more than 3 meters in height, or of more mature stands where trees may be over 15 meters high. Ash habitats resemble the young poplar habitat in the amount of shade at the ground. Within the study area, poplar and ash habitats are abundant and widely distributed although not all contain pools suitable for the development of Aedes mosquitoes. When pools do occur, they range in size from small to extensive and are lined with decaying grasses and leaves (Figs. 8, 9 & 10).

In foliage, the young poplar habitat is characterized by a dense growth of poplar (Populus sp.) although willow (Salix sp.) and alder (Alnus sp.) may also be present. The canopy cover provides moderate shade allowing a thick herbaceous growth at the ground (Fig. 11). Mature poplar habitats exhibit reduced canopy cover and tree density which permits a better developed shrub and herbaceous layer (Fig. 12). The ash habitat is characterized by a density of ash trees (Fraxinus sp.) similar to the mature poplar habitat. A dense canopy cover allows only a sparse shrub growth although grasses may reach as much as .5 meter in height (Fig. 13).

4. Black spruce habitat:

The black spruce habitat results from the filling and growing of lakes and so the water table is high. Although abundant and extensive in distribution within the study area, few black spruce stands contain pools suitable for the development of *Aedes* mosquitoes. The vegetation of the black spruce habitat consists of a continuous mat of sphagnum mosses (*Sphagnum* sp.) on which grows the dominant tree, the black spruce (*Picea mariana*) (Fig. 14).

Pools, when found, are small to medium sized, moss lined depressions, which in some cases may have a sparse lining of grass. Due to the heavy shade afforded by the densely growing black spruce, and the high water table, some pools may contain water all summer. Where pools do not contain water all summer, the moss lining remains very moist.

Since coniferous trees do not shed their foliage, shading is relatively constant throughout the spring and summer.

5. Mixed wood habitat :

Mixed wood habitats are found in low lying areas which are subject to extensive flooding each spring during the snow melt. Such sites are not abundant yet are widely distributed in the study area. Many pools form in deep extensive depressions lined with decaying grass and leaves (Fig. 15).

Many tree types are found, including poplar (*Populus* sp.), ash (*Fraxinus* sp.), birch (*Betula* sp.), black spruce (*Picea mariana*), white spruce (*Picea glauca*), and balsum fir (*Abies balsamea*) in light to heavy density. The shrub growth, heavy in lightly treed areas and lighter in densely treed areas (Fig. 16), consists of willow (*Salix* sp.), alder (*Alnus* sp.), birch (*Betula* sp.), dogwood (*Cornus* sp.) and poplar (*Populus* sp.).

Chapter V

STUDIES OF THE ABUNDANCE AND DISTRIBUTION OF MOSQUITO LARVAE POPULATIONS

Populations of mosquito larvae were quantitatively and qualitatively sampled during the spring and summer of 1971 in order to:

i) follow seasonal changes in the number and size of pools occupied by mosquito larvae populations in each of the five habitat types

ii) follow seasonal changes in the relative density and species compositon of mosquito larvae populations occuring in each of the five habitat types

iii) compare the relative density of mosquito larvae in different habitat types

iv) compare the relative production of mosquito larvae in each of the five habitat types

v) determine if associations exist between particular mosquito species and certain habitat types

(i) Introduction

The density or number of animals in a population may be measured in two ways (Andrewartha, 1961). Whereas computing absolute density would involve counting or estimating all the mosquito larvae in a pool, a measure of relative density would estimate by what ratio the numbers of larvae in one pool exceed those in another, without knowing the actual number of larvae in either pool.

One object of this study is to determine if differences exist in the relative density of mosquito larvae taken in samples from pools in different habitat types. In this respect, mosquito larvae population density was compared between areas differing in the amount and type of vegetative cover, and all pools sampled within one area contribute to the assessment of population density for that area.

An important aspect of sampling is that regardless of the area to be sampled, sampling intensity should remain constant. In the present study, an attempt was made to maintain a constant sampling intensity by having the number of samples taken be proportional to the area sampled. Where pools were extensive, a standard area within the pools was sampled.

(ii) Methods

Sampling was carried out in and around both the Whiteshell Nuclear Research Establishment and the town of Pinawa (Fig. 1). Sites chosen for sampling were classed as disturbed, early regeneration, poplar-ash, black spruce or mixed wood habitats. In sampling, the length and width of each pool was measured in meters.

One 400 cc sample of water was taken from each square meter of water surface area using a standard white enamel dipper. Areas of a pool unsuitable for larvae were not sampled. Hence the area to be sampled or 'effective breeding surface area' was determined by subtracting unsuitable pool surface area from total pool surface area. Where the effective breeding surface area was some whole number plus a fraction, the number of samples taken was proportional to the next highest whole number value of the effective breeding surface area. Where pools had an effective breeding surface area of greater than 25 square meters, one or more 25 square meter areas or quadrats were sampled within such pools.

The number of larvae and pupae in each dipper sample was counted and the individual counts from an entire pool were recorded along with pool length and width, surface area, effective breeding surface area, water pH and temperature in degrees centigrade (Appendix A). For each site and attempt was made to obtain one-hundred or more dipper counts.

From each pool containing larvae, ten larvae were identified (Appendix B). An attempt was made to sample enough pools so as that one-hundred larvae could be identified from each site visited.

Twenty-one sites, the locations of which are shown in Figures 17 and 18, were sampled between 29 April and 25 May, 1971. all sites with previously sampled pools still containing water were again sampled between 31 May and 9 June, 1971 and again on 23 June and 4 August, 1971. Thus all sites were visted and when possible sampled four times throughout the spring and summer of 1971. Due to availability and relative abundance, the number of sites sampled in each habitat type varied as follows: disturbed habitat (7 sites), early regeneration (2 sites), poplar-ash (4 sites), black spruce (3 sites) and mixed wood habitats (5 sites). Sites sampled in and around the town of Pinawa having relatively dense populations of mosquito larvae were larvicided with the insecticide Abate.

The frequency of values for the number of larvae per dip from each site on every sampling date is presented in Appendix C. From these frequency tables, statistical summaries of the frequency distribution for each site on every date sampled have been calculated (Appendix D). These summaries give the sample size, number of samples taken per site and the range, mean, mode and variance of all dipper counts. In addition, the species of mosquito larvae and their proportion of all larvae identified is presented for every date each site was sampled (Appendix E).

A. Seasonal Reduction in the Size and Number of Pools Inhabited by Mosquito Larvae Populations during the Spring and Summer of 1971

In computing the seasonal reduction in pool size and number, the total number and areas of effective breeding surface of all pools sampled in each habitat type was determined for the initial sampling visit. Reduction is expressed as the percentage decrease from the initial size and number for subsequent sampling visits 2, 3 and 4 (Table III).

Examination of Table III reveals that in each habitat type both pool size and number decreases with each successive sampling visit. Early regeneration, black spruce and mixed wood habitat types exhibit the largest initial reduction in pool size, with 91, 91 and 83% reductions, respectively. Disturbed and poplar-ash habitats show a smaller initial reduction in pool size although the disturbed habitat type shows the largest initial reduction in pool number of all habitat types. All previously sampled pools in the poplar-ash, black spruce and mixed wood habitats were dry by the third sampling visit in late June. One pool in the disturbed habitat type still contained water on the sampling visit (Appendix A, Table V, pool 1) and three pools in the early regeneration habitat type contained water on the third visit (Appendix A, Table XXIII, pools 6, 8 & 9).

In spite of the fact that all sites were not

Table III

Seasonal percentage reduction in the size and number of all pools sampled in each habitat type

Sampling Visit	Disturbed	Early Regeneration	Poplar-Ash	Black Spruce	Mixed Wood
	Habitat Type				
2	31-V - 9-VI* Size = 35% # = 70%	1-VI Size = 91% # = 65%	31-V - 9-VI Size = 53% # = 67%	1-VI - 2-VI Size = 91% # = 53%	31-V - 9-VI Size = 83% # = 60%
3	23-VI Size = 68% # = 88%	23-VI Size = 99% # = 85%	23-VI Size = 100% # = 100%	23-VI Size = 100% # = 100%	23-VI Size = 100% # = 100%

* Dates between or on which sampling visits made

(continued)

Table III (continued)

Sampling Visit	Habitat Type				
	Disturbed	Early Regeneration	Poplar-Ash	Black Spruce	Mixed Wood
4	4-VIII* Size = 99% # = 95%	4-VIII Size = 100% # = 100%	4-VIII Size = 100% # = 100%	4-VIII Size = 100% # = 100%	4-VIII Size = 100% # = 100%

* Dates between or on which sampling visits made

visited between 23 June and 4 August, a weekly vist to one site of each habitat type (site 7 - disturbed habitat; site 8 - poplar habitat; site 9 - black spruce habitat; site 10 - early regeneration habitat; site 11 - mixed wood habitat) between 1 June and 12 August showed that despite a total rainfall of 3.86 inches during June and 2.02 inches during July (Appendix F, Tables VI and VII) no pools in each of these sites became reflooded after the initial drying. It is believed that this lack of reflooding occurred in all sites with the exception of one disturbed habitat site where a single pool was found reflooded on the last sampling visit (Appendix A, Tables IV and V, pool).

In summary, all pools sampled in the five habitat types showed a seasonal reduction in size and number. Poplar-ash, black spruce and mixed wood habitats were almost totally dry by the first week in June and completely dry the last week in June. Small percentages of the original size and number of pools persisted in the disturbed habitat type until the first week in August and in the early regeneration habitat type until the last week in June.

Seasonal changes in the size and number of pools depend on a multiplicity of interacting factors. Total snowfall, snow drifting and the amount of snow sublimation during the winter determines the amount of water available for pool formation in the spring. The initial amount of water plus seasonal amounts and periodicity of spring and summer rainfall, wind velocity, humidity and insolation all contribute to the seasonal pattern of change in pool number and size. The number and complexity of these interacting factors makes generalizations on the basis of the 1971 pattern of reduction in pool size and number untenable. In short, only further research will satisfy this unanswered question.

B. Seasonal Changes in the Relative Density and Species Composition of Mosquito Larvae Populations in Different Habitat Types during the Spring and Summer of 1971

Table IV presents the mean and variance of all dipper counts from each of the five habitat types for each one of four sampling visits. With the exception of the disturbed and black spruce habitat types, both the mean number of larvae per dip and the variance of these counts decreases with each successive sampling visit. With respect to the disturbed and black spruce habitat types, the last sampling visit on which pools still contained water showed an increase in the mean and variance of dipper counts.

When last visited, the disturbed habitat type had two sites with pools still containing water (Appendix D, Table IV, sites 3 and 19). Increased larval density occurred in only one pool at site 3 (Appendix A, Table V, pool 1) and consisted of Aedes vexans larvae only (Appendix B, Table IV, pool 1). The last sampling visit to black spruce habitat sites was made between 1 and 2 June when all sites showed an increase in population density as compared to the first sampling visit (Appendix D, Tables X and XI). This increase in population density was accompanied by an increase in the fraction of Aedes communis at each site and of Aedes diantaeus at sites 9 and 12 as well as a decrease in the fraction of Aedes punctor at each site (Appendix E, Tables X and XI).

Table IV

Mean and variance of all dipper counts from each habitat type on each of the four sampling visits

Sampling Visit	Habitat Type: Disturbed	Early Regeneration	Poplar-Ash	Black Spruce	Mixed Wood
1	3-V - 25-V* $\bar{x} = 7.54$ $s^2 = 1325.41$	5-V - 11-V $\bar{x} = 2.80$ $s^2 = 44.43$	5-V - 25-V $\bar{x} = 8.61$ $s^2 = 492.13$	10-V - 13-V $\bar{x} = 7.75$ $s^2 = 416.05$	29-IV - 19-V $\bar{x} = 14.13$ $s^2 = 1802.78$
2	31-V - 9-VI $\bar{x} = .97$ $s^2 = 118.20$	1-VI $\bar{x} - .60$ $s^2 = 1.00$	31-V - 9-VI $\bar{x} = .43$ $s^2 = 8.80$	1-VI - 2-VI $\bar{x} = 37.52$ $s^2 = 9543.82$	31-V - 9-VI $\bar{x} = .97$ $s^2 = 11.37$

* Dates between which sampling visits made

Table IV (continued)

	Habitat Type				
Sampling Visit	Disturbed	Early Regeneration	Poplar-Ash	Black Spruce	Mixed Wood
3	23-VI* $\bar{x}$ = .25 s^2 = .86	23-V $\bar{x}$ = .20 s^2 = .20	**	**	**
4	4-VIII $\bar{x}$ = 7.57 s^2 = 240.78	**	**	**	**

* Date between or on which sampling visits made

** All pools dry

In addition to the change in species composition, the increase in population density was associated with a general decrease in pool size and number (Table III). This reduction in pool size may have concentrated the newly hatched _Aedes communis_ and _Aedes diantaeus_ larvae resulting in an increase in the number of larvae per dip.

The number of species of each genus present at each habitat type on every sampling visit is presented in Table V. In all habitat types, only species of the genus _Aedes_ were present during the first sampling visit. With the second sampling visit, a general reduction in the number of _Aedes_ species present occurs, with the appearence of one species each of _Culex_ and _Culiseta_ at the disturbed habitat type and one _Culex_ species in the poplar-ash habitat type. On the third sampling visit, only pools in the disturbed and early regeneration habitat types contained water. One _Culex_ species was found at the early regeneration and one species each of _Culex_ and _Culiseta_ was found at the disturbed habitat type. By the fourth sampling visit, only those pools found in the disturbed habitat type contained water. One species of the genus _Aedes_, _Anopheles_ and _Culex_ were present. The reappearance of the genus _Aedes_ was represented by the multivoltine species _Aedes vexans_.

In summary, three of the five habitat types show a general reduction in the mean and variance of dipper counts with each successive sampling visit.

Table V

Number of species of each genus present in every habitat type on each of the four sampling visits

Sampling Visit	Disturbed	Early Regeneration	Poplar-Ash	Black Spruce	Mixed Wood
1	3-V - 25-V*	5-V - 11-V	5-V - 25-V	10-V - 13-V	29-IV - 19-V
	14 *Aedes* sp.	13 *Aedes* sp.	10 *Aedes* sp.	5 *Aedes* sp.	15 *Aedes* sp.
2	31-V - 9-VI	1-VI	31-V	1-VI - 2-VI	31-V - 2-VI
	4 *Aedes* sp.	1 *Aedes* sp.	2 *Aedes* sp.	3 *Aedes* sp.	7 *Aedes* sp.
	1 *Culex* sp.		1 *Culex* sp.		
	1 *Culiseta* sp.				

* Dates between or on which sampling visits made

(continued)

Table V (continued)

Sampling Visit	Habitat Type: Disturbed	Early Regeneration	Poplar-Ash	Black Spruce	Mixed Wood
3	23-V* 1 Culex sp. 1 Culiseta sp.	23-VI 1 Culex sp.	**	**	**
4	4-VIII 1 Aedes sp 1 Anopheles sp. 1 Culex sp.	**	**	**	**

* Dates upon which sampling visits made

** All pools dry

Both the disturbed and black spruce habitat types showed and increase in the mean and variance of dipper counts on the last sampling visit when pools were found still containing water. Initially, only species of the genus *Aedes* were present. Successive sampling visits showed a reduction in the number of *Aedes* species and the presence of the genus *Culex*, *Culiseta* and *Anopheles*.

C. Seasonal Production of Mosquitoes during the Spring and Summer of 1971

Mosquito production of an area may be expressed as the product of the size of developmental sites and population density of mosquito larvae in those sites. Where developmental site size is the effective breeding surface area of pools and population density the mean number of larvae per dip in these pools, mosquito production is an estimate of the actual or absolute number of mosquitoes developing in these pools. If mosquito production of the initial sampling visit is let equal unity (1.00), then relative production on subsequent sampling visits may be compared to this initial value using the product of the fraction of initial pool size still remaining on each subsequent visit (a measure of pool size reduction) and population density on each subsequent visit divided by initial population density (a measure of population density increase or decrease). Products greater than 1.00 indicate increases over initial mosquito production; those less than 1.00 indicate decreases in mosquito production. Table VI presents mosquito production on sampling visits 2, 3 and 4 relative to initial mosquito (first sampling visit) in all five habitat types.

Examination of Table VI reveals that a drastic reduction in mosquito production occurred in disturbed, early regeneration, poplar-ash and mixed wood habitat

Table VI

Relative mosquito production in all habitat types on sampling visits 1, 2, 3 and 4

Sampling Visit	Habitat Type: Disturbed	Early Regeneration	Poplar-ash	Black Spruce	Mixed Wood
1 29-IV - 25-V*	1.00	1.00	1.00	1.00	1.00
2 31-V - 9-VI	0.08	0.02	0.02	0.44	0.01
3 23-VI	0.01	<0.01	0.00	0.00	0.00
4 4-VIII	0.01	0.00	0.00	0.00	0.00

* Dates between or on which sampling visits made

types between the first and second sampling visits. The black spruce habitat type does not exhibit as great a reduction in mosquito production. This fact is due to much lower pool water temperatures in this habitat type. For example, during the second sampling visit, pool temperatures in the black spruce habitat sites ranged between 6° and 15° C (average = 9.5° C) (Appendix A, Tables, XXXII, XXXIV & XXXVI) whereas pool water temperatures in the disturbed habitat sites ranged between 10° and 22° C about an average of 15.8° C (Appendix A, Tables III, VII, IX, XI, XIV, XVIII). Subsequently, mosquito larvae in the black spruce habitat type were still developing when larvae of the same species in other habitat types had already completed development. Mosquito production occurred in only two habitat types after the second sampling vist. Production at this time was extremely low as compared to that of the initial sampling visit.

In conclusion, except for the black spruce habitat type, mosquito production was minimal after the first sampling visit. Retarded larval development produced a time lag in the reduction of mosquito production in the black spruce habitat type. During the spring and summer of 1971, almost all mosquito production occurred during the time in which the first sampling visit was made (29 April - 25 May).

Both the rate of pool reduction in size and number plus the extent to which pools become reflooded with spring and summer rain may determine the seasonal pattern of mosquito production. If for example pools are initially small and dry before mosquito larvae have completed development, the decrease in the relative production of mosquitoes over a specified period of time would be greater than was observed during the spring and summer of 1971. If on the other hand, spring and summer rains reflood drying pools, one or more generations of multivoltine *Aedes* could develop, thus reducing the decrease in the seasonal production of mosquitoes. For these reasons, the seasonal pattern of mosquito production observed during the spring and summer of 1971 may not be typical.

D. Relative density of mosquito larvae in different habitat types during the spring of 1971

As previously demonstrated, almost all mosquito production during the 1971 season was restricted to a period in the early spring during which time the first sampling visit to all sites was made (29 April - 25 May). At this time, only mosquito larvae of the genus *Aedes* were present. Due to the great reduction in pool size and number, larval density and hence mosquito production after the first sampling visit, a consideration of mosquito larvae density (as estimated by the average number of larvae per dip) in different habitat types has been restricted to those data collected during the first sampling visit.

Table VII presents the mean number of larvae per dip, variance and the number of dips taken at each of sites 1 - 21. In addition, the proportion of *Aedes implicatus* at each site is given. Sites are arranged in chronological order with respect to sampling date (vertically) and according to their habitat type (horizontally). Examination of Table VII reveals that with the exception of site 3, the mean number of larvae per dip is roughly correlated with habitat type, large values for the mean number of larvae per dip being associated with the more densely vegetated habitat types (eg. poplar-ash, black-spruce, mixed wood). The large mean dipper count at site 3 is due to several outstandingly high dipper counts which generate a correspondingly large variance. Similarly

Table VII

Mean and variance of dipper counts and proportion *Aedes implicatus* at sites 1 - 21 sampled between 29 April and 25 May, 1971

Sampling Date	Habitat Type: Disturbed	Early Regeneration	Poplar-ash	Black-spruce	Mixed wood
29-IV					1. 29.8; 6981.3* (140) .53
3-V	2. 1.3; 2.7[a] (140) .80				
3-V	3. 39.0; 8053.6* (108) .89				
4-V					4. 10.0; 168.5 (117) .32
5-V		6. 3.1; 73.3 (154) .55	5. 7.6; 40.9 (71) .76		
6-V	7. 5.1; 132.8 (108) .35				
10-V			8. 29.4; 1821.1* (85) .81	9. 3.5; 165.9 (100) .00	

(continued)

Table VII (continued)

Sampling Date	Habitat Type: Disturbed	Early Regeneration	Poplar-ash	Black-spruce	Mixed wood
11-V		10. 2.5; 9.8 (128) .06			11. 10.3; 121.5 (115) .03
12-V				12. 3.6; 25.4 (90) .00	
13-V				14. 34.0; 1594.0* (32) .09	13. 13.2; 77.8 (120) .00
19-V	15. 1.4; 1.8 (100) .00				
19-V	16. 0.9; 2.0 (100) .00				17. 2.6; 8.8 (100) .00
20-V	19. 2.8; 4.5 (100) .00		18. 2.3; 13.8 (107) .00		
25-V	20. 2.3; 6.4 (100) .00		21. 0.3; 0.3 (100) .00		

a: $s.\frac{\bar{x};\ S^2}{(n)\ \ p}$ where s = site number; $\bar{x}$ = mean number of larvae per dip; S^2 = variance of of dipper counts; n = number of dipper counts; p = proportion <u>Aedes implicatus</u>

* = aggregations of mosquito larvae

high counts were recorded at sites 1, 8 and 14. At sites 1, 3 and 8 these large dipper counts occurred in samples from both large and small pools (Appendix A, Table XXXVII, pools 1, 7 and 13; Table II, pools 2 and 6; Table XXV, pools 2, 5, 9 and 10) and were the result of aggregations of Aedes implicatus larvae (Appendix B, Table XXXV, pools 1, 7 and 13; Table II, pools 2 and 6; Table XXI, pools 2, 5, 9 and 10) as is shown in Fig. 19. The larvae of Aedes excrucians, Aedes intrudens, Aedes trichurus, Aedes canadensis, Aedes communis and Aedes punctor were at times found comprising small proportions of these aggregations (Appendix B, Table II, pool 6; Table XXXV, pool 7). The large variance and mean number of larvae per dip at site 14 is due to several high dipper counts (Appendix A, Table XXXV, pools 2 and 5) resulting primarily from aggregations of Aedes communis and Aedes punctor larvae (Appendix B, Table XXXIII, pools 2 and 5). Aggregations of Aedes communis have been described by other authors (Hocking 1953; Haufe 1957). Aggregations of mosquito larvae tend to induce overestimates of mosquito larvae density, a fact which should be remembered when considering the mean number of larvae per dip at sites 1, 3, 8 and 14.

Further examination of Table VII reveals that the proportion of Aedes implicatus at sites 1 to 8, sampled before 10 May was between .89 and .32. These sites are representative of all habitat types except the black spruce type. Sites sampled after 10 May (sites 9 - 21) were found to contain Aedes implicatus only rarely, and then only in small proportions (.06 - .09). This drastic and abrupt change in abundance was not observed in any other species of mosquito larvae. The presence of Aedes implicatus in high proportions in all sites sampled before 10 May and absence or presence in only small proportions in sites sampled after 10 May suggests that this species may have been present in sites 9 - 21 but entered the adult stage before these sites were sampled. The lack of of observations of pupal exuviae in sites 9 - 21 weakens this hypothesis.

Associated with the reduction in the proportion of Aedes implicatus is a general reduction in the mean number of larvae per dip in the disturbed, early regeneration and poplar-ash habitat types suggesting that in these habitat types mosquito larva density is related to the proportion of Aedes implicatus larvae present. By contrast, with the exception of site 17, no such reduction was found to occur in the black spruce and mixed wood habitat types suggesting that mosquito larvae density is not related to the proportion of Aedes implicatus in these sites.

In summary, the mean number of larvae per dip (as an estimate of mosquito larva population density) generally increases with increased vegetative cover and with the exception of both the black spruce and mixed wood habitat types, the density of mosquito larvae decreases with decreases in the proportion of Aedes implicatus.

E. Relative Production of Aedes Mosquitoes in Different Habitat Types during the Spring of 1971

As previously defined, mosquito production is the product of the size of developmental sites and the mean population density in such sites. Where developmental site size is the total effective breeding surface area of all pools in a given area and the mean number of larvae per dip in these pools is a measure of population density, mosquito production is an estimate of the actual or absolute number of mosquitoes developing in that area. Comparison of the relative production of mosquitoes in different habitat types is based on the numbers of mosquitoes developing in equal unit areas of each habitat type. In order that such a comparison may be made, some measure of the relative amounts of effective breeding surface area in different sites must be made. Four hypothetical examples of indices of relative effective breeding surface area, along with the conditions they describe are presented in Table VIII. For the situation in which effective breeding area per unit area habitat was greatest, an index value of 1.00 is given. Other cases where the amount of effective breeding area is less than that situation with an index of 1.00 have indices expressed as fractions.

In assessing each site for its index of effective breeding surface area, a representative area of approximately 1000 square meters was surveyed. The index is an estimate and not based on actual measurements.

Table VIII

Indices of effective breeding surface area

Situation	Index
a) entire site under water	1.00
b) equal water and dry land	0.50
c) only about 1/10 of area covered by pools	0.10
d) less than 1/100 of area covered by pools	0.01

Using the mean number of larvae per dip and the index of effective breeding surface area for each site, the relative mosquito production index for each site sampled during the initial sampling visit is given in Table IX.

Examination of Table IX reveals that of the five habitat types, the mixed wood habitat sites, with the exception of site 17, produced more mosquitoes per unit area than the sites of any other habitat type. In those sites where the mean number of larvae per dip is large (sites 3, 8 and 14), small effective breeding surface area indices reduce the relative mosquito production index to a small value.

Table IX

Index of effective breeding surface area, $\bar{x}$ number of larvae/dip and the relative mosquito production index for all sites sampled during the first sampling visit of 29 April to 25 May, 1971

Habitat type	Site #	$\bar{x}$ # larvae/dip	Index of effective breeding surface area	Index of relative mosquito production
Disturbed	2	1.3	0.5	0.65
	3	39.0	0.1	3.90
	7	5.1	0.1	0.51
	15	1.4	1.0	1.40
	16	0.9	0.5	0.45
	19	2.8	1.0	2.80
	20	2.3	1.0	2.30
Early Regeneration	6	3.1	0.1	0.31
	10	2.5	0.1	0.25

Table IX (continued)

Habitat type	Site #	$\bar{x}$ # larvae/dip	Index of effective breeding surface area	Index of relative mosquito production
Poplar-ash	5	7.6	0.5	3.80
	8	29.4	0.01	0.29
	18	2.3	0.5	1.15
	21	0.3	1.0	0.30
Black spruce	9	3.5	0.5	1.75
	12	3.6	0.1	0.36
	14	34.0	0.01	0.34
Mixed wood	1	29.8	1.0	29.80
	4	10.0	1.0	10.00
	11	10.3	1.0	10.30
	13	13.2	1.0	13.20
	17	2.6	0.5	1.30

F. Associations Between Certain Species of Mosquito Larvae and Particular Habitat Types

During the spring and summer of 1971, 22 species of mosquito larvae, distributed among three genera were collected from the twenty-one sites sampled. The species and percentages of each in all larvae identified from each site on each of the four sampling visits are presented in Tables X - XIII. Certain species of mosquito larvae showed marked associations with particular habitat types. These are discussed in the following:

Aedes absserratus was taken only from the black spruce and mixed wood habitat types (Table X). Of the 2626 mosquito larvae identified during the spring and summer of 1971, only 6 were *Aedes absserratus*.

With respect to habitat type, *Aedes communis* was ubiquitous. Of all 13 sites of disturbed, early regeneration and poplar-ash habitat types, *Aedes communis* was found in only 4, and when found, did not comprise more than 5% of the mosquito larvae populations with which it was associated (Table X). Its percentage of mosquito larvae populations in the black spruce and mixed wood habitat types was much greater. Of the 5 sites of mixed wood habitat type sampled, it was found in 4, where its percentage of mosquito larvae populations was as great as 33%. Three sites of the black spruce habitat type were sampled. During the first sampling visit, *Aedes communis* was found in only one site, where its percentage of the larval mosquito population was 30% (Table X). With the second sampling visit, a greater percentage of Aedes communis had hatched, and larvae were found in all three black spruce habitat sites, where its percentage of associated populations was between 1 and 63% (Table XI).

Of interest is the fact that during both sampling visits, this species was found comprising the greatest percentage of mosquito larvae populations at black spruce habitat site 14. Pools sampled at site 14 did differ from those sampled at black spruce habitat sites 9 and 12. Sites 9 and 12 are well within black spruce (Picea mariana) stand and the almost complete absence of deciduous shrub growth results in pools being lined with only moss (Sphagnum sp.) and decaying grass (Fig. 20). By contrast, pools at site 14 are located along the transition between a black spruce and mixed wood habitat type. This area is more open and deciduous shrub or tree growth is not uncommon. Low alder (Alnus sp.) shrub growth was found among most pools sampled and as a result the bottoms of pools at this site were covered with a mat of decaying leaves (Fig. 21).

Aedes diantaeus was found in 2 of the 6 early regeneration and poplar-ash habitat sites sampled in proportions of 7 and 3% (Table X). During the first sampling visit, Aedes diantaeus was found in all three sites of the black spruce habitat type in percentages of 2 to 16% and in sites of the mixed wood habitat type it was taken from 3 out of the 5 sampled in percentages of 1 to 9%. It was not found in the disturbed habitat type. At the time of the second sampling visit, all three black spruce habitat sites contained Aedes diantaeus larvae in percentages of 9 to 41% (Table XI) whereas it was present in only 1 of the 3 sampled mixed wood habitat sites where its percentage was 59%.

Aedes intrudens was taken in only 2 of the 9 disturbed and early regeneration habitat sites in percentages not greater than 3% (Table X). It was taken from 6 of the 9 poplar-ash and mixed wood habitat sites in percentages between 3 and 21% suggesting that Aedes intrudens is associated more with the wooded poplar-ash and mixed wood habitat types than the treeless disturbed and almost treeless early regeneration habitat types.

Aedes punctor was found in 7 of the 8 black spruce and mixed wood habitat sites (Table X). Whereas it formed between 5 to 41% of mosquito larvae populations in the mixed wood habitat type, its percentage in black spruce habitat sites ranged between 53 and 97%. It was collected from only 2 of the 9 disturbed and early regeneration sites in percentages of not greater than 17%. It was not found in the poplar-ash habitat type.

Aedes trichurus was found in the disturbed, early regeneration and mixed wood habitat types (Table X). It was taken from only 3 of the 9 sites in percentages not greater than 12%. It was found in 2 of the 5 mixed wood sites sampled in percentages of 9 and 68%.

Aedes riparius was found in 6 of the 7 disturbed, all of the early regeneration and only 2 of the 5 mixed wood habitat sites (Table X). Whereas Aedes riparius larvae comprise between 1 and 36% of larvae populations in the disturbed and early regeneration habitat sites, its percentage of larval populations in the mixed wood habitat type was not greater than 7%. It was not found in poplar-ash and black spruce habitat types.

Culiseta minnesotae larvae were taken from only the disturbed habitat type in percentages of 6 and 100% (Tables XI and XII). In agreement with the findings of Price (1961), larvae were found close to and associated with the edges and clumps of emergent vegetation in open semi-permanent pools (eg. sites 19 and 20).

Culiseta morsitans was taken from only the black spruce habitat type (Table XII) where it was found in deep moss lined pockets situated under the roots and trunks of black spruce (Picea mariana) trees. Similarly, Matheson (1944), reported his taking the larvae of Culiseta morsitans only from water filled holes under old tree stumps but Price (1961) reported that the larvae of this species could also be found in open as well as wooded situations.

In summary, Aedes abserratus, Aedes communis, Aedes diantaeus, Aedes intrudens, Aedes punctor, Aedes trichurus and Culiseta morsitans were found to be associated with heavily wooded areas whereas both Aedes riparius and Culiseta minnesotae were associated with the more open habitat types.

Table X

Mosquito species and percentages of each at sites 1 - 21 during the first sampling visit, 29 April - 25 May, 1971

Species	I[a]							II		III				IV			V				
	2	3	7	15	16	19	20	6	10	5	8	18	21	9	12	14	1	4	11	13	17
Aedes abserratus														3	1					2	
Aedes barri				12	4		4		1		3	19	17						1	6	32
Aedes canadensis				1	1			2			7	3					1	3	1		
Aedes cinereus			1	4	3	5	1				3	38	16					1	4		7
Aedes communis	4		5						1	1						30	13	27	33	1	
Aedes diantaeus									7			3		12	2	16	1	2	9		
Aedes dorsalis	1																				
Aedes excrucians		1	6	17	16	74	77		15		1	32	58				2		1	15	50
Aedes fitchii	4	3	25	65	76	4	3	39			5	1	8								10
Aedes implicatus	80	89	35					55	6	76	81					1	53	32	3		
Aedes intrudens		1							3	21		4					3	17		4	
Aedes punctor			7						17					85	97	53	16	6	41	5	
Aedes riparius	6	5	16	1		17	15	1	36	3							2		7		1
Aedes sticticus			1						2												
Aedes stimulans																	1				

(continued)

Table X (continued)

	Sites of each habitat type																				
	I							II		III				IV			V				
	2	3	7	15	16	19	20	6	10	5	8	18	21	9	12	14	1	4	11	13	17
Aedes spencerii	4		3					3										4			
Aedes trichurus		2	1						12								9	9		68	

Note: 100 larvae identified from each site

a = habitat types, where I = disturbed; II = early regeneration; III = poplar-ash; IV = black spruce; V = mixed wood

Table XI

Mosquito species and percentages of each at sites 1 - 21 during the second sampling visit, 31 May - 9 June, 1971

Species	Sites of each habitat type I[a]							II		III				IV			V				
	2	3	7	15	16	19	20	6	10	5	8	18	21	9	12	14	1	4	11	13	17
Aedes barri																			7		
Aedes canadensis			100														18		2		
Aedes cinereus		11		5							20						50				13
Aedes communis														11	1	63			2		
Aedes diantaeus														41	9	24			59		
Aedes excrucians		20							100								18		30	67	
Aedes fitchii																	15			33	
Aedes punctor														49	90	14					
Aedes vexans		69		81									100								87
Culex territans				14							80										
Culiseta minnesotae							100														
# larvae identified	*	35	12	21	**	**	1	*	10	*	5	**	31	37	124	88	34	**	46	3	15

a = habitat types, where I = disturbed; II = early regeneration; III = poplar-ash; IV = black spruce; V = mixed wood

* = all pools dry; ** = pools sampled but larvae not present

Table XII

Mosquito species and percentages of each at sites 1 - 21 during the third sampling visit, 23 June, 1971

Species	Sites of each habitat type																				
	I[a]							II		III				IV			V				
	2	3	7	15	16	19	20	6	10	5	8	18	21	9	12	14	1	4	11	13	17
Aedes punctor														75	75						
Culex territans						100	94		100												
Culiseta minnesotae							6														
Culiseta morsitans														25	25						
# larvae identified	*	**	*	*	*	1	36	*	2	*	*	*	*	2	4	*	*	*	*	*	*

a = habitat types, where I = disturbed; II = early regeneration; III = poplar-ash; IV = black spruce; V = mixed wood

* = all pools dry; ** = pools sampled but larvae not present

Table XIII

Mosquito species and percentages of each at sites 1 - 21 during the fourth sampling visit, 4 August, 1971

Species	Sites of each habitat type																				
	I[a]							II		III				IV			V				
	2	3	7	15	16	19	20	6	10	5	8	18	21	9	12	14	1	4	11	13	17
Aedes vexans		100																			
Anopheles earlei						14															
Culex territans						86								100							
# larvae identified	*	10	*	*	*	7	*	*	*	*	*	*	*	5	*	*	*	*	*	*	*

a = habitat types, where I = disturbed; II = early regeneration; III = poplar-ash; IV = black spruce; V = mixed wood

* = all pools dry

Chapter VI

STUDIES OF THE DISTRIBUTION AND ABUNDANCE OF ADULT MOSQUITO POPULATIONS

Part 1

Sampling Adult Female Mosquito Populations using Solid CO_2-Baited Traps during the Spring and Summer of 1970 and 1971

(i) Introduction

Among other methods, adult mosquito populations may be sampled using methods involving attraction to lures. Light (Southwood, 1966), large and small vertebrates (Roberts, 1965; Worth & Jonkers, 1962), contrasting patterns (Haufe and Burgess, 1960) and carbon dioxide gas (Reeves, 1951) have been used as mosquito attractants. Methods not involving lures employ suction traps which sample volumes of air at known rates (Service, 1969) and Malaise traps which intercept and capture mosquitoes as they fly at random (Breeland and Pickard, 1965).

As a factor in the attraction of mosquitoes to hosts, carbon dioxide may be obtained from dry ice (Bellamy and Reeves, 1952) or compressed gas cylinders (Graham, 1969) where it has been used in conjunction with a number of trap designs (Bellamy and Reeves, 1952; Reeves, 1951; Graham, 1969; DeFoliart and Morris, 1967; Schreck et al., 1970) and also in combination with light (Newhouse et al., 1966) where it increases both the number of individuals and species in mosquito light trap catches.

Despite the widespread use of carbon dioxide as a mosquito attractant, certain limitations involved in its use must be recognized. Since some mosquito species are more attracted by carbon dioxide than are others (Graham, 1969), the proportions of species caught in a trap which utilizes carbon dioxide may not be representative of the proportions which actually exist in the adult mosquito population. Also as in any trapping method, changes in the numbers caught are reflections of not population density but population activity. As Graham (1969) has pointed out, activity and population peaks are probably similar, although this is not known with certainty.

The use of carbon dioxide in attractant traps has certain advantages. Whereas most other attractant traps require a source of electricity for operation, the carbon dioxide trap is self-contained and can be used in areas where light traps or others could not be used. In addition, the trap used in this study caught large numbers of mosquitoes only, saving the labor of sorting. Specimens caught in CO_2 traps were generally un-damaged, a necessary prerequisite when identifying mosquitoes.

(ii) Methods

The trap used during the spring and summer of 1970 and 1971 is illustrated in Figure 22. This trap captures, kills and collects mosquitoes as follows: solid carbon dioxide contained in the cylinder sublimes and leaves the trap as shown in Figure 22; mosquitoes are 'attracted' by the CO_2 and enter the trap at entrance number 1; once within the area enclosed by the outer wall, mosquitoes walk or fly to trap entrance number 2 and enter; on entering the inner chamber mosquitoes are asphyxiated, fall into the collecting bottle and die.

Trap cylinders were loaded with approximately 500-600 grams of solid carbon dioxide which was wrapped in a constant amount of paper towelling to restrict the rate of sublimation. For any trapping evening, traps were set out between 7:00 and 8:00 P.M. and collected between 8:00 and 9:00 A.M. the following morning. On collection, traps always had some solid carbon dioxide remaining the the cylinder. Traps were not operated on excessively windy evenings or during rain since both mosquito activity and trap efficiency are thought to be reduced at this time. Traps were set among trees or other available supports approximately 1 meter from the ground as is illustrated in figures 23 and 24.

During the spring and summer of 1970, traps were placed at six locations (Fig. 25) representative of five habitat types. Sites 1, 7 and 8 were sampled for larval abundance and species composition during the spring and summer of 1971 whereas sites 22, 23 and 24 are sites where no such sampling was done. Traps were operated from 16 June through to 12 August. It was not always possible to trap on the same evening and all sites were not trapped an equal number of times. The species of adult female mosquitoes and the numbers of each caught at the six locations during the spring and summer of 1970 is presented in Appendix G.

Throughout the spring and summer of 1971, traps were set out at seven sites (Fig. 25) representative of the five habitat types. Sites 7 to 11 are sites previously sampled for larvae during the spring and summer of 1971 whereas site 25, a lawn area at the Whiteshell Nuclear Research Establishment and site 26, a park in Pinawa, were not previously sampled for larvae. All seven traps were operated on the same evening for 14 evenings between 1 June and 12 August. The species of adult female mosquitoes and numbers of each caught at each of the seven locations for each of the 14 trapping evenings is given in Appendix H.

A. Proportions Expressed as Precentages of Species of Adult Female Mosquitoes Trapped during the Spring and Summer of 1970 and 1971

The mosquito species and proportions expressed as percentages of all adults trapped during the spring and summer of 1970 and 1971 is presented in Table XIV. Of the twenty-four mosquito species trapped during the 1970 season, Aedes vexans, Aedes punctor and Aedes abserratus comprized 85.16% of all those caught, Aedes vexans accounting for 74.40%. During 1971 a total of 23 mosquito species were trapped. Again, Aedes vexans, Aedes punctor and Aedes abserratus constituted a large percentage of the total seasonal catch (82.42%) but the percentage of Aedes vexans decreased from 74.40% during 1970 to 51.56% during 1971 and that of Aedes punctor increased from 6.29% to 24.33%. Since Aedes abserratus is an early spring species, the commencement of trapping two weeks earlier during the 1971 season as compared to the 1970 season may have increased the percentage of this species in the total seasons catch.

Table XIV

Percentage by species of all adults trapped during the spring and summer of 1970 and 1971

Species	% total CO_2 trap catches	
	1970	1971
Aedes abserratus	4.47	6.53
Aedes barri	.19	.14
Aedes canadensis	.06	.18
Aedes cinereus	*	1.16
Aedes communis	.06	.90
Aedes diantaeus	*	.04
Aedes dorsalis	.31	.11
Aedes excrucians	.31	.25
Aedes fitchii	.88	1.26
Aedes flavescens	.88	.86
Aedes implicatus	.19	2.30
Aedes intrudens	.63	.50
Aedes punctor	6.29	24.33
Aedes pionips	.06	**
Aedes riparius	.38	1.94

* = not trapped during the 1970 season

** = not trapped during the 1971 season

(continued)

Table XIV (continued)

	% total CO_2 trap catches	
	1970	1971
Aedes sticticus	5.22	.22
Aedes spencerii	.57	2.80
Aedes trichurus	.50	3.62
Aedes trivittatus	*	.04
Aedes vexans	74.40	51.56
Anopheles walkeri	1.38	.14
Culiseta inornata	.13	**
Culiseta minnesotae	.25	.14
Culex tarsalis	.13	**
Culex restuans	.06	**
Mansonia perturbans	2.33	.14
non-identifiable	.31	.39
Total trapped	1590	2787

* = not trapped during the 1970 season

** = not trapped during the 1971 season

B. Seasonal Changes in the Numbers and Species of Mosquitoes Trapped during the Spring and Summer of 1970 and 1971

Based on relative abundance and seasonal distribution, the twenty-six species of mosquitoes trapped during the spring and summer of 1970 and 1971 may be placed in one of four groups. Group 1 includes the 16 univoltine spring *Aedes* species; group 2 consists of the three multivoltine summer *Aedes* species; group 3 contains 2 species each of the genus *Culex* and *Culiseta* and 1 species of *Anopheles*; and group 4 has but one species, *Mansonia perturbans*. Tables XV and XVI present the proportions of groups 1, 2, 3 and 4 and the average number of mosquitoes trapped from all sites sampled on each trapping evening for both 1970 and 1971.

lthough considerable variation exists in the average numbers of mosquitoes caught on successive evenings, the general trend for both 1970 and 1971 is an average decrease as the season progresses. Accompanying this decrease is a general reduction in the proportion of group 1 mosquitoes and increase in group 2 mosquitoes. Group 2 was composed almost entirely of *Aedes vexans* during both years. Group 3 mosquitoes increased in proportion during 1970 while during the 1971 season they remained at a constant proportion while present. Group 4, represented by only *Mansonia perturbans*, first appeared on the same

Table XV

Proportion of groups 1, 2, 3 and 4 and the average number of mosquitoes trapped from all sites sampled on each of thirteen trapping evenings between 16 June and 12 August, 1970

	Sampling Date												
	June		July								August		
	16	29	2	8	9	15	23	26	28	29	3	4	12
# sites sampled	3	3	1	2	1	2	2	1	2	3	1	2	1
$\bar{x}$ # trapped	47	283	49	187	71	12	10	10	11	21	1	2	3
proportion group 1	.30	.10	.80	.12	.20	.20	.15	.10	.27	.05	.00	.00	.33
proportion group 2	.70	.89	.20	.76	.80	.55	.35	.90	.46	.95	1.0	1.0	.66
proportion group 3	.00	.01	.00	.03	.00	.25	.20	.00	.27	.00	.00	.00	.00
proportion group 4	.00	.00	.00	.09	.00	.00	.02	.00	.00	.00	.00	.00	.00

Table XVI

Proportion of groups 1, 2, 3 and 4 and the average number of mosquitoes trapped from all seven sites sampled on each of fourteen trapping evenings between 1 June and 12 August, 1971

	Sampling Date													
	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
# sites sampled	7	7	7	7	7	7	7	7	7	7	7	7	7	7
$\bar{x}$ # trapped	27	15	24	57	34	12	12	42	17	74	48	9	16	9
proportion group 1	1.0	.98	.99	.89	.93	.46	.60	.35	.16	.18	.21	.15	.18	.12
proportion group 2	.00	.02	.00	.11	.07	.54	.39	.65	.83	.80	.79	.85	.81	.88
proportion group 3	.00	.00	.01	.00	.00	.00	.01	.00	.00	.01	.00	.00	.01	.00
proportion group 4	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.00	.00	.00	.00

date both summers and was present for a short time in small proportions.

In summary, a seasonal reduction in the number of mosquitoes trapped is accompanied by a decrease in the proportion of univoltine spring *Aedes* and increase in the proportion of multivoltine summer *Aedes*. Species of the genus *Culex*, *Culiseta* and *Anopheles* increased in proportion during the 1970 season while when present during the 1971 season remained at a constant proportion. *Mansonia perturbans* was present during both years in small proportions for only a short period in mid-July.

C. Seasonal Distribution and Estimated Longevity of Adult Female Mosquitoes during the 1970 and 1971 Seasons

As revealed by CO_2 trapping, the seasonal distribution in the appearance of the different mosquito species is given in Figures 26 and 27 for the 1970 and 1971 seasons. The earliest species, the spring *Aedes* are followed by the summer *Aedes* and species of the genus *Culex*, *Culiseta* and *Mansonia*. This same pattern has been reported from Minnesota by Barr (1958). The lapse in time between the spring and summer *Aedes* is not as evident during the 1970 season since trapping was begun almost three weeks later than during the 1971 season. During 1970, *Aedes dorsalis* and *Aedes sticticus* occured earlier than in 1971 whereas *Aedes intrudens*, *Aedes communis* and *Aedes canadensis* occurred later.

The longevity of adult mosquitoes is influenced by characteristics of the mosquito species, activity of the individual mosquito, climate and incidence of parasites and predators (Bates, 1949). Assuming that members of a particular species emerge at about the same time during the spring or early summer, a measure of their longevity may be inferred from the duration of time during which they are present in CO_2 trap catches. This hypothesis applies only to the univoltine species, since the period of time during which multivoltine species are present may represent more than one generation.

Certain limitations of this method of maximum longevity estimation must be realized. Since the method estimates from the occurrence of trapped mosquitoes, longevity applies to only those species attracted by CO_2. It is conceivable that after a certain time, a species may not be influenced by CO_2, its maximum longevity thereby being underestimated. Estimates of longevity made in this fashion may also be influenced by the relative abundance of a species, the chance of trapping an abundant species being greater than that of trapping a rare species.

The number of days between the first and last trapping of each species is given in Figures 26 and 27. For the spring Aedes of 1970 this estimate may be somewhat reduced by the fact that trapping did not commence until mid-June. Since mosquito abundance is extremely low by mid-August, discontinuation of trapping at this time does not greatly reduce the estimates of maximum longevity.

In general, longevity was considerably greater in almost all species during the 1971 season and may be attributable to the earlier commencement and more thorough method of trapping. For this reason, only estimates of maximum longevity obtained during the 1971 season will be considered. The estimated longevity of individual univoltine species varies between 7 and 73 days. Since Aedes *diantaeus* was trapped only once, no estimate of its longevity may be made. *Mansonia perturbans*, estimated as being the shortest lived of all 23 species, was found to have an unusually high incidence of parasitism by mites. Such parasitism may contribute to the observed short life span of this species.

D. Number of Mosquitoes Trapped in Different Habitat Types

Since the method of trapping employed during the 1970 season was not completely standardized, a comparison of the numbers of mosquitoes trapped in different habitat types will be made only on the basis of the 1971 trapping data. The numbers of mosquitoes trapped during each trapping evening and the mean and variance of the total numbers caught on all trapping evenings is presented for each of the seven sites used during the 1971 season (Fig. 28).

Examination of Figure 28 reveals that considerable variation may exist between the numbers caught during successive evenings and during all trapping evenings of one season. Excluding site 8, the mean number of mosquitoes caught during the entire season at each site increases with increased vegetative cover. Site 8, intermediate with respect to vegetative cover, has the largest mean number of mosquitoes caught of all seven sites. During 1971, the largest catch on any one evening was made at site 8 on 13 July and consisted almost entirely of *Aedes vexans* (Appendix H, Table V). The largest catch (651 mosquitoes) of the 1970 season was made at this same site on 29 June and again consisted almost entirely of *Aedes vexans* (Appendix G, Table IV). The second largest catch of the 1970 season was taken on 8 July at site 1 and consisted of approximately 66% *Aedes vexans* (Appendix G, Table VI). Although sites 8 and 1 are not of the same habitat type, the traps were positioned at both of these sites within the woods approximately 10 meters from the interface between the woods and open field. The large numbers of mosquitoes trapped at these two sites may represent concentrations of *Aedes vexans* in such areas or increased trap efficiency when situated in such locations.

E. Species - Habitat Associations

During the 1970 season, trapping was done on an irregular basis, all habitat types not being sampled an equal number of times or on the same evenings. For this reason, the assessment of associations between mosquito species and habitat types is made only on the basis of the 1971 trapping results.

Two measures of habitat association are used. One was the fraction of the total season's catch represented by each species at each site. The other was the number of times a species was trapped at each site as a fraction of all successful trapping evenings at a site (frequency of capture). Table XVII presents the frequency of capture and fraction of the total season's catch by species for the seven sites sampled.

Three species, viz., *Aedes cinereus*, *Aedes fitchii* and *Aedes punctor* are associated with wooded areas as compared to more open areas. In Minnesota, Barr (1958) found biting females of *Aedes cinereus* much more abundant in wooded areas than in open areas and in Alberta, Happold (1965b) found that *Aedes fitchii* and *Aedes punctor* form larger percentages of adult mosquito populations in heavily wooded than in open areas. Both Mail (1936) and Hearle (1926) found *Aedes punctor* to be primarily a mosquito of heavely wooded areas.

Aedes dorsalis, *Aedes flavescens* and *Aedes spencerii*, common prairie mosquitoes (Rempel, 1953), are

Table XVII

Mosquito species, their frequency of capture and fraction of all mosquitoes trapped at each of 7 sites during the 1971 season

	Site number and habitat type						
	I[a]			II	III	IV	V
Species	24[b]	25	7	10	8	9	11
Aedes abserratus	[c].14(.3)[d]		.04(.6)	.05(.5)	.06(.6)	.04(.5)	.12(.6)
Aedes barri		.03(.1)	.01(.1)		<.01(.1)		<.01(.1)
Aedes canadensis				.01(.1)		.01(.3)	
Aedes cinereus				.01(.1)	.01(.4)	.01(.2)	.05(.9)
Aedes communis			.04(.2)		.01(.1)	.01(.1)	.01(.1)
Aedes diantaeus						<.01(.1)	
Aedes dorsalis		.06(.2)	.01(.1)				
Aedes excrucians					.01(.2)		.01(.3)
Aedes fitchii			.01(.1)	.01(.1)	.01(.4)	.02(.4)	.02(.4)
Aedes flavescens			.02(.4)	.05(.2)	<.01(.1)	.01(.2)	.01(.1)

(continued)

Table XVII (continued)

	Site number and habitat type						
	I[a]			II	III	IV	V
Species	24[b]	25	7	10	8	9	11
Aedes implicatus	.05[c](.1)[d]		.04(.1)	.10(.2)	.01(.3)	.03(.3)	.01(.1)
Aedes intrudens	.02(.1)		.01(.1)	.01(.2)	<.01(.2)	<.01(.1)	<.01(.1)
Aedes punctor	.09(.4)	.12(.3)	.12(.7)	.09(.4)	.09(.7)	.49(1)	.37(1)
Aedes riparius	.02(.1)		.06(.2)	.01(.2)	.01(.3)	.01(.3)	.03(.1)
Aedes sticticus					.01(.3)		
Aedes spencerii	.02(.1)	.21(.2)	.18(.5)	.01(.2)	<.01(.1)	<.01(.1)	<.01(.1)
Aedes trichurus	.02(.1)		.18(.5)	.05(.2)	<.01(.2)	.03(.3)	.01(.4)
Aedes trivittatus						<.01(.1)	
Aedes vexans	.59(.7)	.58(.6)	.27(.8)	.55(.7)	.79(.8)	.35(.9)	.35(.8)
Anopheles walkeri	.05(.2)		.01(.2)				
Culiseta minnesotae			<.01(.1)	.01(.1)			<.01(.1)
Mansonia perturbans				.01(.1)	<.01(.1)		

(continued)

Table XVII (continued)

a = habitat type: I = disturbed; II = early regeneration; III = poplar-ash;
IV = black spruce; V = mixed wood

b = site number

c = fraction of total number of mosquitoes trapped during entire season

d = frequency of capture (total number of evenings on which mosquitoes caught divided by the number of evenings species caught) found associated with open treeless terrain. Although *Aedes intrudens* and *Aedes trichurus* are considered forset mosquitoes (Rempel, 1953; Barr, 1958), they also are found to be associated with the more open, treeless areas.

Part 2

Sampling Adult Mosquito Populations by Biting Collections during the Spring and Summer of 1971 in Pinawa, Manitoba

(i) Introduction

The collection of individual adult female mosquitoes as they land and attempt to feed may provide valuable information on the identity, relative abundance and seasonal succession of pest mosquito populations. Trapping the mosquitoes attracted to man insured that the pest population is being sampled, a fact which the use of various traps may not insure. In addition, many of the early spring Aedes are morphologically similar and hence difficult to separate. Damaged specimens are often non-identifiable. Catching individual mosquitoes by hand prevents damage, thereby making identification less time-consuming and more accurate.

The collection of mosquitoes in such a manner does have certain limitations. The attractiveness of different collectors may vary (Muirhead-Thomson, 1968), the catching efficiency of a collector may vary between collections and some species of mosquitoes may be more difficult to catch than others. This last fact is particularily evident when comparing the attacking behaviour of Mansonia perturbans and Aedes vexans. Whereas Mansonia perturbans may be described as a 'bold' attacker, once alighting not being easily disturbed, Aedes *vexans* is a 'cautious' attacker, its feeding being easily disrupted by movement. This difference in behaviour may clearly introduce a bias into the sampling of these two species.

(ii) Methods

Fifteen collections were made, approximately one per week between 1 June and 12 August, 1971 in a park area along the shore of the Winnipeg River in Pinawa, Manitoba (Fig. 25, site 24). Collection commenced one-half hour before sunset and continued until a total of 25 mosquitoes had been obtained, individual mosquitoes being trapped as they landed on all parts of the front of the collectors body using a 115 cc collecting bottle containing a wad or ether soaked cotton wool. The time required to collect 25 mosquitoes was recorded. After collection, mosquitoes were returned to the laboratory and stored in a freezer over-night to insure that they would be killed. Specimens were mounted and identified the following morning. The number of each species and the time required to collect 25 mosquitoes is given for each of the 15 collection evenings between 1 June and 12 August, 1971, in Appendix I.

A. Pest Mosquito Species during the Spring and Summer of 1971

Of the thirty-one mosquito species known to occur in the Pinawa area, sixteen species representing three genera were collected attempting to feed on man. The percentage by species of all mosquitoes collected during the 1971 season is presented in Table XVIII. Six species; *Aedes vexans*, *Aedes absserratus*, *Aedes intrudens*, *Mansonia perturbans*, *Aedes communis* and *Aedes punctor* made up 84.07% of all mosquitoes collected.

Of particular interest is *Aedes absserratus* which was found to be extremely rare as larvae yet abundant in CO_2 trap collections and a major pest in the town of Pinawa (Table XIX). The presence of an abundance of adults yet rareness or absence of larvae of this species has been reported elsewhere (West and Hudson, 1960; Jenkins and Knight, 1952; Brust, personal communication, 1972). At Pinawa this observation may be explained on the hypothesis that: 1) this species is rare yet has a high affinity for CO_2 and man; 2) the larval habitat was not found; or 3) many of the *Aedes absserratus* adults collected may be the 'tundra' variety of *Aedes punctor* as described by Knight (1951).

At Pinawa, a few *Aedes absserratus* larvae were taken from black spruce and mixed wood habitat types and in agreement with Haufe (1952), Beckel and Atwood (1959), Matheson (1944) and Brust and Kalpage (1967) were found

Table XVIII

Percentage of mosquito species collected attempting to feed on man during the spring and summer of 1971 at Pinawa, Manitoba

Species	%	Species	%
Aedes vexans	20.60	non-identifiable	1.60
Aedes abserratus	17.60	Aedes dorsalis	1.07
Mansonia perturbans	16.27	Aedes fitchii	.80
Aedes intrudens	13.60	Aedes riparius	.80
Aedes communis	5.87	Aedes excrucians	.53
Aedes punctor	5.33	Aedes sticticus	.29
Aedes abserratus-punctor *	3.20	Aedes flavescens	.27
		Aedes cinereus	.27
Aedes spencerii	2.93	Anopheles earlei	.27
Aedes trichurus	2.13		
Aedes communis-intrudens *	1.60		

total number of mosquitoes collected = 375

* = further separation to species not possible

Table XIX

Proportions expressed as percentages of mosquito species collected as larvae, and adults in CO_2 traps and by biting collections during the 1971 season

Species	larvae	CO_2	biting collections
Aedes abserratus	.19	6.53	17.60
abserratus-punctor*	.00	.00	3.20
barri	3.35	.14	.00
canadensis	1.37	.18	.00
cinereus	3.50	1.16	.27
communis	7.08	.90	5.87
communis-intrudens*	.00	.00	1.60
diantaeus	4.87	.04	.00
dorsalis	.04	.11	1.07
excrucians	13.98	.25	.53
fitchii	8.99	1.26	.80
flavescens	.00	.86	.27
implicatus	20.56	2.30	.00
intrudens	2.21	.50	13.60
punctor	18.81	24.33	5.33
riparius	4.07	1.94	.80
spencerii	.53	2.80	2.93
sticticus	.11	.22	.29

* further separation not possible

(continued)

Table XIX (continued)

Species	larvae	CO_2	biting collections
Aedes stimulans	.04	.00	.00
trichurus	4.30	3.62	2.13
trivittatus	.00	.04	.00
vexans	3.62	51.56	25.60
Anopheles earlei	.04	.00	.27
walkeri	.00	.14	.00
Culex territans	2.09	.00	.00
Culiseta minnestoae	.11	.14	.00
morsitans	.11	.00	.00
Mansonia perturbans	**	.14	16.27
non-identifiable	.00	.39	1.60

** larval habitat not sampled

abserratus larvae, but presence of adults has been observed elsewhere, it is suggested that the two forms of Aedes punctor might be present at Pinawa and that a certain percentage of adults identified as Aedes abserratus may in fact be the 'tundra' variety of Aedes punctor. Such a situation would explain the rareness of Aedes abserratus larvae and 'apparent' abundance of the adults of this species. In addition, it would help explain the abundance of Aedes punctor larvae and adults in CO_2 trap samples but reduced abundance in biting collections (Table XIX), since many Aedes punctor ('tundra' variety) taken in biting collections may have been misidentified as Aedes abserratus. If true, this would suggest that the 'tundra' variety of Aedes punctor has a greater affinity for man or more readily invades the openess of the town as compared to the 'type punctor' variety of Aedes punctor. Only further research will elucidate the exact nature of this intriguing problem.

Aedes implicatus comprised between .35 and .89 of larvae identified from sites of all but the black spruce habitat type during the first two weeks in May, 1971. The abundance of this species as larvae but rareness in CO_2 trap collections and absence in biting collection samples is striking. In addition to the fact that the 1971 season may have been exceptional (although adult females were also rare in 1970 CO_2 trap collections - Table XIV) this observation may indicate that Aedes implicatus populations are partially autogenous, are not readily attracted to CO_2 or man and may not readily enter the CO_2 trap and difficult to capture by hand when making biting collections.

Although Culex territans has been reported attempting to feed on man (Mean, 1965) its absence from both CO_2 trap and biting collection samples yet presence as larvae (Table XIX) tends to support the generally accepted claim that this species feeds on cold blooded vertebrates (eg. amphibians and reptiles) (Carpenter and LaCasse, 1955; Barr, 1958; Tempelis, 1970).

Aedes vexans was abundant in CO_2 and biting collection samples (Table XIX), but was relatively rare in the larval stage. This is due to the fact that the developmental sites of this species are localized in the disturbed habitat type and few in number. In addition, adult females have a greater affinity for CO_2 than many other mosquito species (Graham, 1969).

B. Seasonal Changes in the Abundance and Species Composition of the Pest Mosquito Population

The mosquito species as proportions of the total of 25 caught each collection evening are presented in Table XX. Of the collections made between 1 and 17 June, *Aedes communis*, *Aedes abserratus* and *Aedes intrudens* were the most abundant species although these collections also contained small proportions of *Aedes trichurus*, *Aedes excrucians* and *Anopheles earlei*. Collections made between 21 June and 20 July are composed of between five to nine species, no one species contributing to more than .48 of a single collection and some as little as .08. Collections made between 26 July and 12 August are comprised primarily of *Aedes vexans*, the proportion ranging between .44 and .92 and generally increasing as the season progresses.

The biting collection data of the 1971 season may be summarized as is shown in Figure 29. The sixteen mosquito species may be divided into three groups: group 1, early spring *Aedes* and one species of *Anopheles*; group 2, summer *Aedes*; and group 3 which is represented by but one species, *Mansonia perturbans*. The early spring *Aedes*, initially most abundant, decrease in abundance with time with a corresponding increase of summer *Aedes*. The relative abundance of *Mansonia perturbans* resembles a normal distribution, its peak in abundance occuring in mid-July.

Table XX

Mosquito species and their fraction of the total of 25 caught in biting collections every sampling evening during the spring and summer of 1971 at Pinawa, Manitoba

Species	Sampling Date														
	June							July						August	
	1	8	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes communis	.60	.08	.04		.04	.08		.04							
Aedes abserratus	.36	.72	.20	.32	.24	.24		.36	.16	.04					
Aedes intrudens	.04	.16	.68	.64		.20	.04	.16	.04	.08					
Aedes punctor					.40		.16	.04	.12	.04	.04				
Aedes abserratus-punctor							.16		.04		.16		.12		
Aedes communis-intrudens							.24								
Aedes vexans					.08	.08	.08	.04	.16	.36	.24	.60	.44	.92	.84
Aedes trichurus			.04		.08	.04	.16								
Aedes excrucians			.04	.04											
Aedes fitchii					.08	.04									

(continued)

Table XX (continued)

Species	June 1	June 8	June 14	June 17	June 21	June 23	June 28	July 1	July 5	July 8	July 13	July 20	July 26	August 4	August 12
Aedes riparius					.04	.08									
Aedes flavescens					.04										
Aedes dorsalis						.04	.04								.08
Aedes sticticus									.04	.20	.08		.04	.04	.04
Aedes spencerii												.04			
Aedes cinereus															.04
Anopheles earlei		.04													
Mansonia perturbans						.20	.12	.36	.44	.16	.48	.24	.40	.04	
Non-identifiable										.12		.12			

As a measure of mosquito abundance, the time required to collect twenty-five mosquitoes tends to fluctuate throughout the season, although it is stable for most of June and the latter part of July and first two weeks in August. Mosquito abundance (as estimated by collection time), tends to decrease throughout the season, with mosquitoes three-fold greater in abundance during June as compared to late July and August. This indicates that the spring *Aedes* are responsible for the highest level of pest mosquito annoyance during the 1971 season at Pinawa, Manitoba.

Chapter VII

SUMMARY

1. Six genera and forty-five species of mosquitoes have been recorded from Manitoba. At Pinawa, thirty-one species were recorded and are distributed among the six genera as follows: *Aedes* - 21 species; *Anopheles* - 2 species; *Culex* - 2 species; *Culiseta* - 3 species; *Mansonia* - 1 species; and *Wyeomyia* - 1 species.

2. Five types of mosquito habitats are described. In order of increasing vegetative cover these are the disturbed, early regeneration, poplar-ash, black spruce and mixed wood habitat types.

3. During the 1971 season, all pools sampled in the five habitat types showed a seasonal reduction in size and number. Poplar-ash, black spruce and mixed wood habitat pools were almost totally dry by the first week in June and completely dry the last week in June. Small percentages of the original size and number of pools persisted in the disturbed habitat type until the first week in August and in the early regeneration habitat type until the last week in June. Once dry, only a few pools in the disturbed habitat type became reflooded with rain.

4. Studies of the seasonal changes in the relative density and species composition of mosquito larvae populations revealed that in general, mosquito larvae density decreased throughout the 1971 season. Initially only species of the genus Aedes were present. With time, a reduction in the number of species of Aedes larvae occured with the subsequent occurrence of species of the genus Culiseta, Culex and Anopheles.

5. Mosquito production was found to decrease as the 1971 season progressed. In all but the black spruce habitat type, mosquito production in the first week in June was not greater than .08 of that in the first three weeks of May. During the same time a .56 reduction was observed in the black spruce habitat type. By the third week in June, mosquito production of all habitat types was not greater than .01 of that in the weeks of May. Mosquito production during July and August was further reduced.

6. In general, mosquito larva density increased with increased vegetative cover; density being least in the disturbed and greatest in the mixed wood habitat type.

7. More mosquitoes developed per unit area in the mixed wood habitat type than in all other habitat types.

8. As larvae, Aedes abserratus, Aedes communis, Aedes

diantaeus, Aedes intrudens, Aedes punctor, Aedes trichurus and Culiseta morsitans were found to be associated with heavily wooded areas whereas both Aedes riparius and Culiseta minnesotae were associated with more open habitat types.

9. Between 16 June and 12 August, 1970 and 1 June and 12 August, 1971 adult female mosquitoes were captured in the five habitat types using CO_2 baited traps.

10. Of 1590 mosquitoes trapped during the 1970 season, Aedes vexans, Aedes punctor and Aedes absserratus comprised 85.16% of all those caught, Aedes vexans accounting for 74.40%. During the 1971 season, 2787 mosquitoes were trapped, Aedes vexans, Aedes punctor, and Aedes absserratus again constituting a large percentage of the season's catch (82.42%). Aedes vexans was 51.56 and Aedes punctor 24.33% of the seasonal catch. Earlier commencement of trapping is proposed as the reason for the greater number of Aedes punctor caught during 1971.

11. A seasonal reduction in the numbers of mosquitoes trapped occurred during both the 1970 and 1971 seasons and was accompanied by a decrease in the proportion of univoltine spring Aedes and increase in the proportion of multivoltine summer Aedes. Species of the genus Anopheles,

Culex and Culiseta increased in proportion during the 1970 season while remaining at a constant proportion during the 1971 season. Mansonia perturbans was present during both years in only small proportions for a short period in mid-July.

12. The estimated longevity of individual univoltine species during the 1971 season varied between 7 and 73 days, Aedes punctor being the longest-lived (73 days) and Mansonia perturbans the shortest-lived (7). The seasonal distribution of adult female mosquitoes was determined for 1970 and 1971.

13. During the 1971 season, considerable variation existed between the numbers of mosquitoes caught during all trapping evenings of one season. In general, the mean number of mosquitoes caught per evening increased with increases in vegetative cover.

14. Aedes cinereus, Aedes fitchii, and Aedes punctor were found to be associated with wooded areas whereas Aedes dorsalis, Aedes flavescens, Aedes specerii, Aedes intrudens and Aedes trichurus are associated with more open treeless areas.

15. Collecting those mosquitoes attempting to feed on man in a recreational area of Pinawa revealed that of the thirty-one mosquito species known to occur in the Pinawa area, sixteen were collected attempting

to feed on man. _Aedes vexans_, _Aedes abserratus_, _Mansonia perturbans_, _Aedes intrudens_, _Aedes communis_ and _Aedes punctor_ made up 84% of all mosquitoes collected (375).

16. _Aedes abserratus_ was a major pest species during 1971 (17.60% of all mosquitoes collected) yet it was rare as larvae (.19% of all larvae identified). In part, it may have been misidentified as the 'tundra' variety of _Aedes punctor_.

17. Although _Aedes implicatus_ made up between .89 and .35 of early spring larval populations in all but the black spruce habitat type, it was not collected attempting to feed on man.

18. Accompanying a general decrease in the intensity of pest mosquito attack was a decline in the proportion of spring Aedes in the pest mosquito population as well as an increase in the proportion of summer multivoltine Aedes. The proportion of _Mansonia perturbans_ increased after 23 May, peaked during mid-July and then decreased.

Figure 1. Location of the study area in south-eastern Manitoba (upper right) and the locations of the Whiteshell Nuclear Research Establishment and the town of Pinawa within the study area (lower centre).

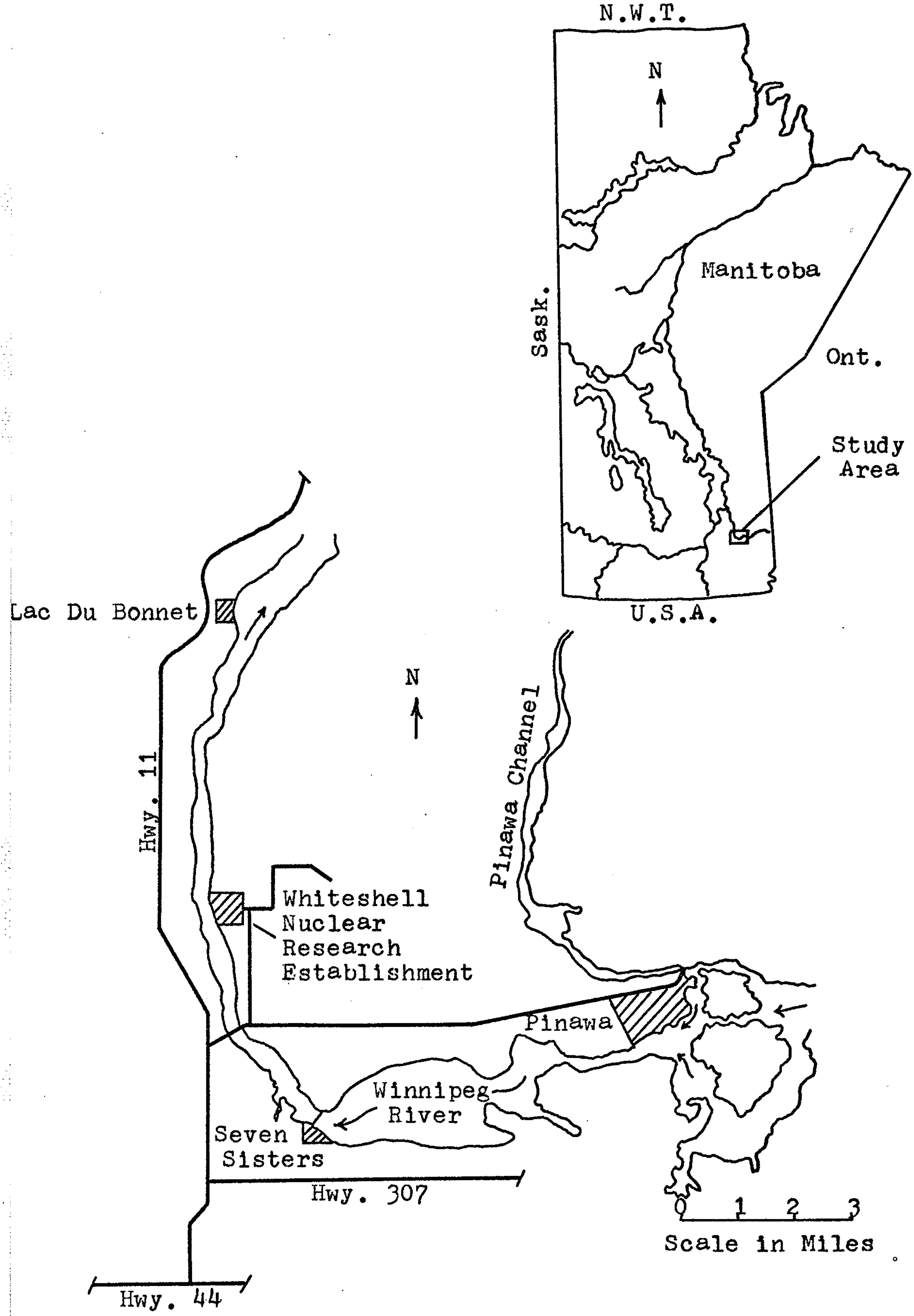

N.W.T.
N
Manitoba
Sask.
Ont.
Study
Area
U.S.A.
Lac Du Bonnet
N
Pinawa Channel
Hwy. 11
Whiteshell
Nuclear
Research
Establishment
Pinawa
Winnipeg
River
Seven
Sisters
Hwy. 307
0 1 2 3
Scale in Miles
Hwy. 44

Figure 1

Figure 2. An abandoned farmer's field at the Whiteshell Nuclear Research Establishment is typical of a disturbed habitat where small, irregular, grass lined pools have resulted from vehicular traffic. (Date: 6 May, 1971)

Figure 3. The site of a future road within the town of Pinawa, Manitoba is typical of a disturbed habitat where large pools have resulted from soil removal. (Date: 19 May, 1971)

Figure 2

Figure 3

Figure 4. The site of a future road within the town of Pinawa, Manitoba. Pools do not dry until mid-May and for this reason, in addition to the growth of herbaceous plants (foreground), emergent vegetation (background) grows at those places where pools formed. (Date: 4 August, 1971)

Figure 5. Abandoned farmer's field at the Whiteshell Nuclear Research Establishment. Most pools at this site dry before the end of May; thus only herbaceous growth is found. (Date: 4 August, 1971)

Figure 4

Figure 5

Figure 6. Early regeneration habitat illustrating a deep, large (36 M^2), grass lined pool. (Date: 11 May, 1971)

Figure 7. Early regeneration habitat showing tall grass and clumps of shrub growth. Some emergent vegetation is present since pools did not completely dry until mid-June. (Date: 4 August, 1971)

Figure 6

Figure 7

Figure 8. Young poplar habitat showing an extensive (400 M^2), shallow, grass lined pool. (Date: 10 May, 1971)

Figure 9. Mature poplar habitat showing a large (18 M^2) grass and leaf lined pool. (Date: 5 May, 1971)

Figure 8

Figure 9

Figure 10. An ash habitat showing where a series of large pools have formed due to the restriction of water flow by deadfall. (Date: 20 May, 1971)

Figure 11: Young poplar habitat illustrating the moderate canopy cover with a heavy growth of herbaceous plants (Date: 4 August, 1971)

Figure 10

Figure 11

Figure 12. Mature poplar habitat illustrating reduced tree density and canopy cover. A well developed shrub and herbaceous layer exists at this site. (Date: 4 August, 9171)

Figure 12

Figure 13. An ash habitat, illustrating the densce canopy cover, lack of shrub growth and tall growth of grass which may be as much as .5 meter in height. (Date: 4 August, 1971)

Figure 14. A black spruce habitat where black spruce trees grow on a continuous mat of sphagnum moss. The large depression (10 M^2) shown is typical in that it is lined with moss and some grass. (Date: 12 May, 1971)

Figure 13

Figure 14

Figure 15. Typical mixed wood habitat showing a very extensive (500 M^2), grass and leaf lined pool. (Date: 13 May, 1971)

Figure 16. Mixed wood habitat where moderate canopy cover permits a well developed shrub and herbaceous growth. (Date: 4 August, 1971)

Figure 15

Figure 16

Figure 17. Town of Pinawa, Manitoba showing the locations of larval sampling sites 1 - 6 and 13 - 21.

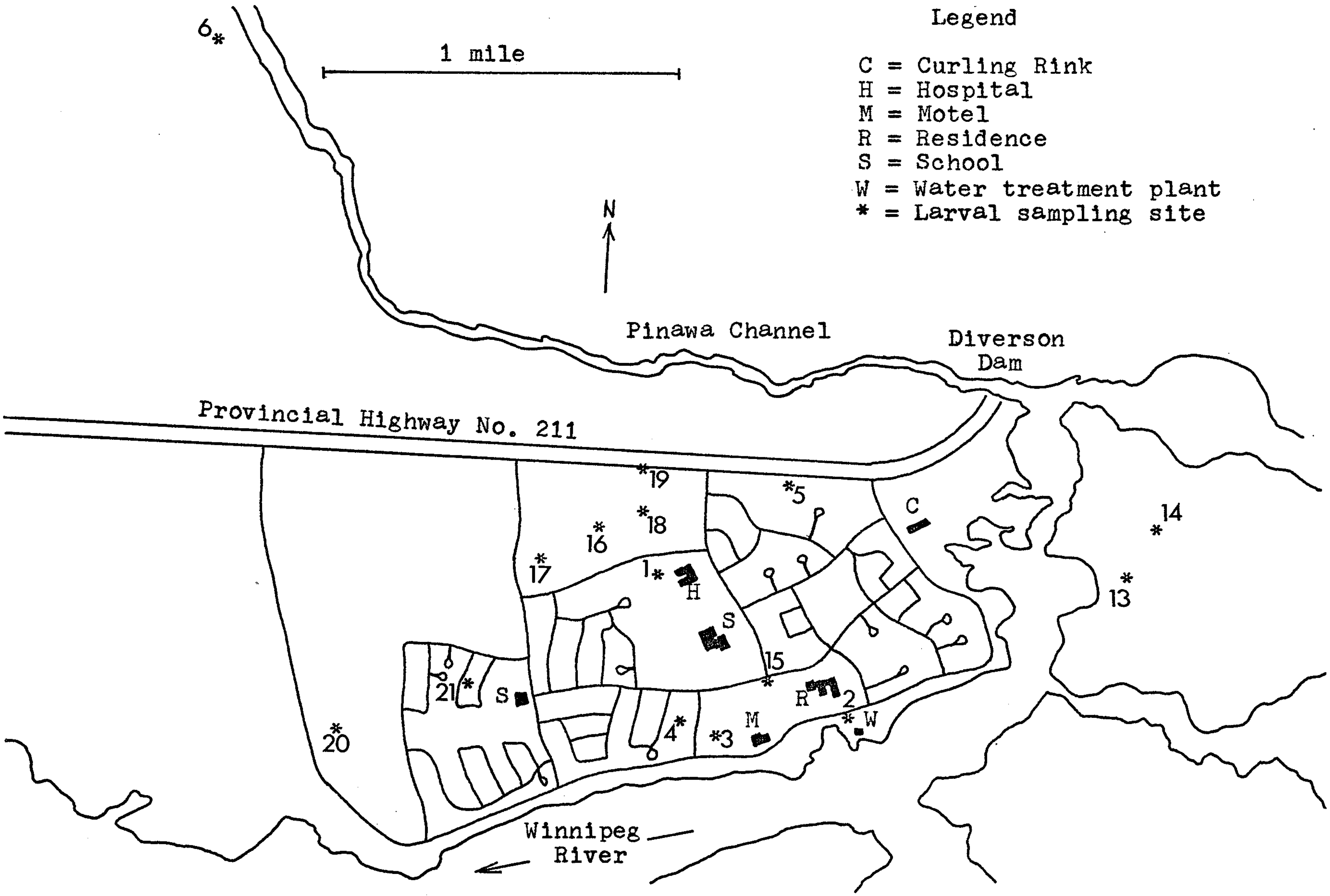
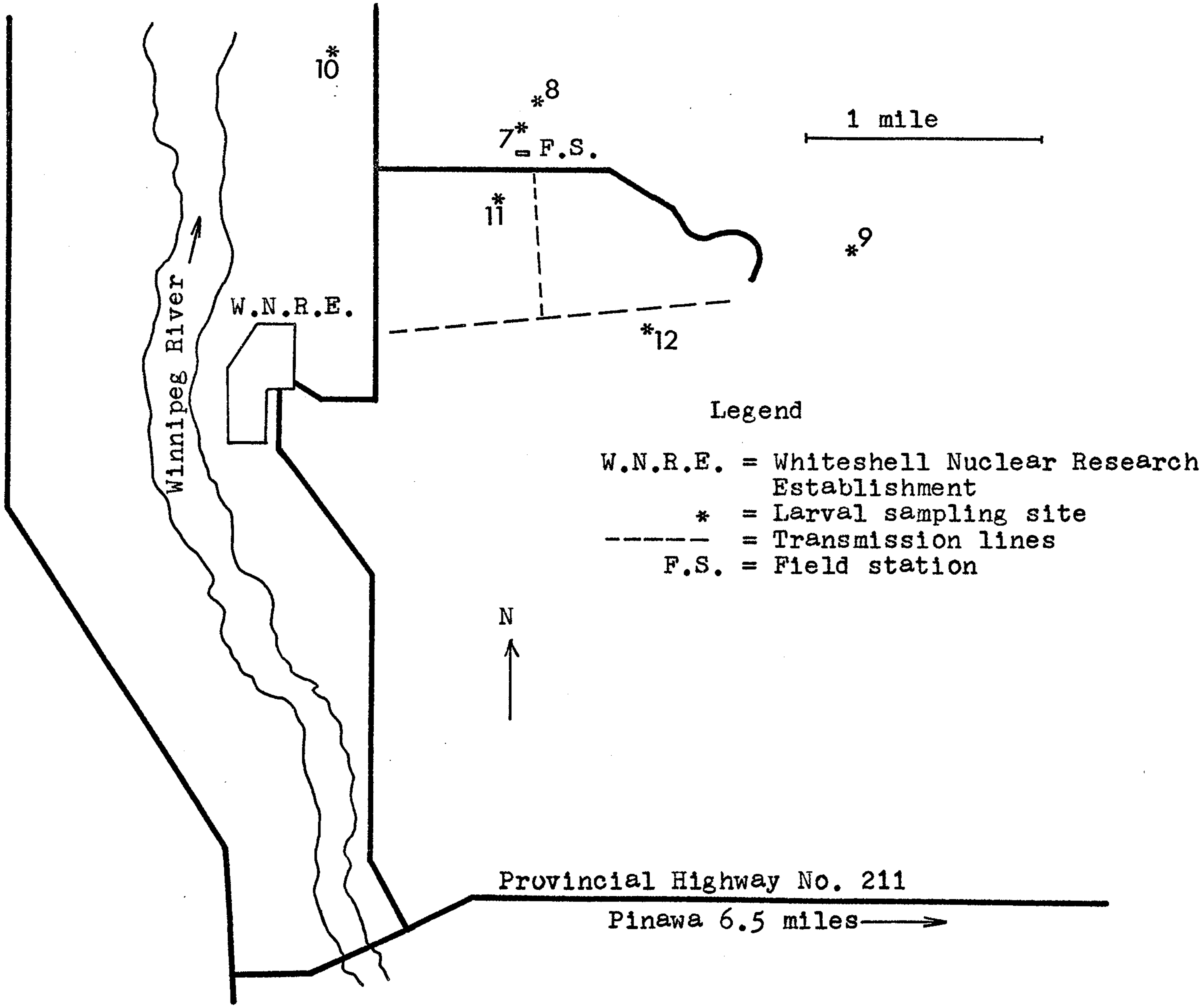

Legend
C = Curling Rink
H = Hospital
M = Motel
R = Residence
S = School
W = Water treatment plant
* = Larval sampling site
1 mile
N
Pinawa Channel
Diverson Dam
Provincial Highway No. 211
Winnipeg River
C
H
S
S
M
R
W
1
2
3
4
5
6
13
14
15
16
17
18
19
20
21

Figure 17

Figure 18. Whiteshell Nuclear Research Establishment showing larval sampling sites 7 - 12.



10
8
7
F.S.
1 mile
11
9
Winnipeg River
W.N.R.E.
12
Legend
W.N.R.E. = Whiteshell Nuclear Research Establishment
* = Larval sampling site
------ = Transmission lines
F.S. = Field station
N
Provincial Highway No. 211
Pinawa 6.5 miles

Figure 18

Figure 19. An aggregation of *Aedes implicatus* larvae in a shallow, grass lined pool as observed in pool 2, site 3, 3 May, 1971. (larvae approx. 1/5 life size)

Figure 20. Black spruce habitat site 9. Note the abscence of deciduous shrub growth around pool number 7 which results in such pools being lined with only moss (*Sphagnum* spp.) and decaying grass. *Aedes communis* forms small proportions of mosquito larvae populations in such pools.

Figure 19

Figure 20

Figure 21. Black spruce habitat site 14. Low shrub growth of alder (*Alnus* sp.) results in pools being lined with decaying leaves as well as moss (*Sphagnum* sp.) and decaying grass. *Aedes communis* comprises higher proportions of the mosquito larvae population when in addition to moss and decaying grass, decaying leaves are also present.

Figure 21

Figure 22. Schematic diagram of the CO_2 baited trap used during the spring and summer of 1970 and 1971. The paths of both CO_2 gas and an attracted mosquito are also shown (upper right).

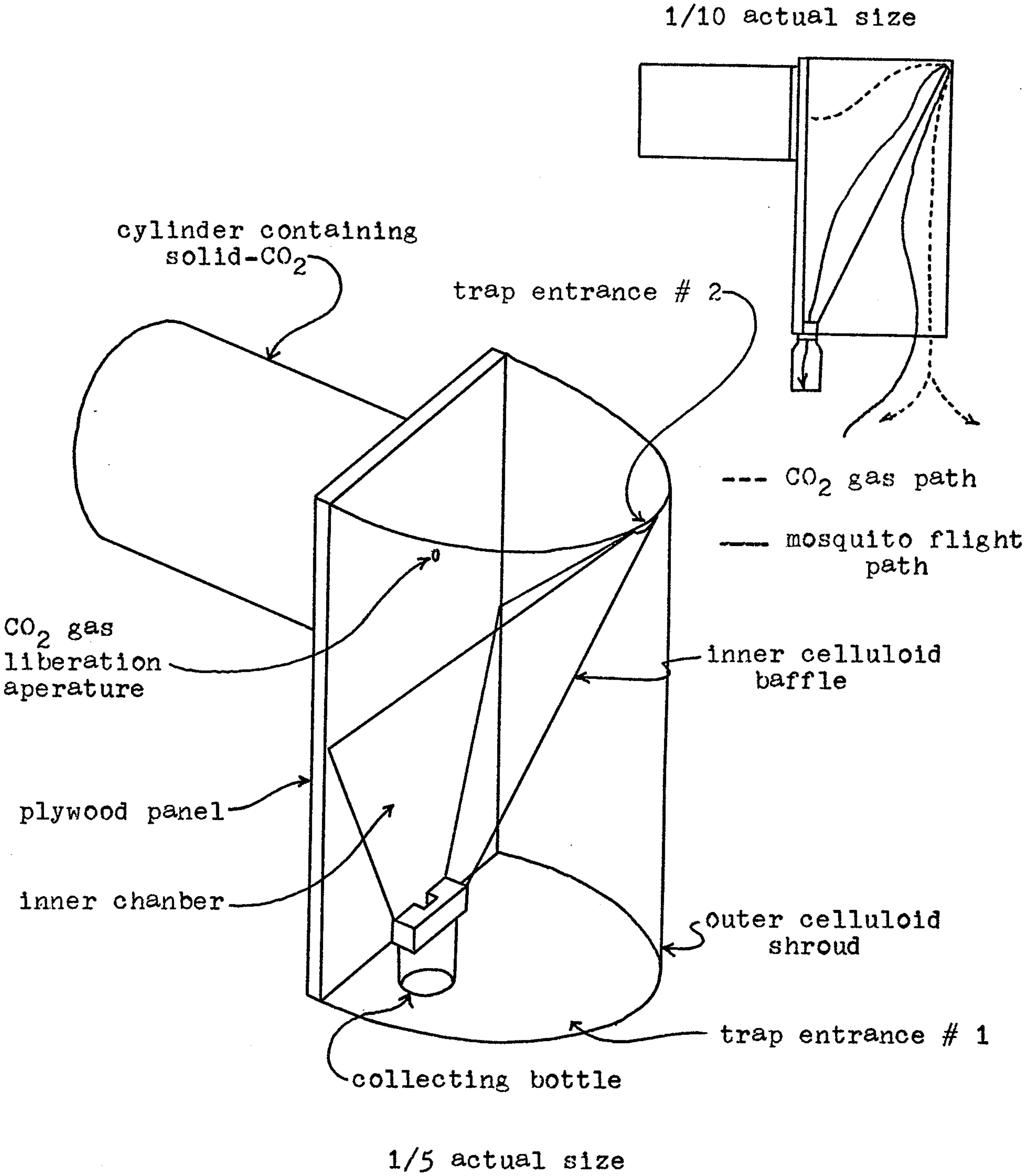

1/10 actual size
--- CO_2 gas path
—— mosquito flight path
cylinder containing solid-CO_2
trap entrance # 2
CO_2 gas liberation aperature
inner celluloid baffle
plywood panel
inner chanber
outer celluloid shroud
trap entrance # 1
collecting bottle
1/5 actual size

Figure 22

Figure 23. CO_2-baited trap resting on post approximately 1 meter from the ground at disturbed habitat site number 7. (Date: 26 July, 1971)

Figure 24. CO_2-baited trap resting on fallen tree at black spruce habitat site number 9. (Date: 26 July, 1971)

Figure 23

Figure 24

Figure 25. Map of the Whiteshell Nuclear Research Establishment and the town of Pinawa, Manitoba showing the locations of CO_2 trapping sites. The sites, habitat type of each and years used are given below.

Site #	Habitat type	Years used
1	Mixed wood	1970
7	Disturbed	1970 + 71
8	Poplar-ash	1970 + 71
9	Black spruce	1971
10	Early regeneration	1971
11	Mixed wood	1971
22	Early regeneration	1970
23	Black spruce	1970
24[a]	Disturbed	1970
25[a]	Disturbed	1971
26[a,b]	Disturbed	1971

a = grass kept cut

b = not a disturbed habitat in the strict sense since deciduous trees were present; classified as disturbed since all shrub growth removed and grass kept cut

Figure 25

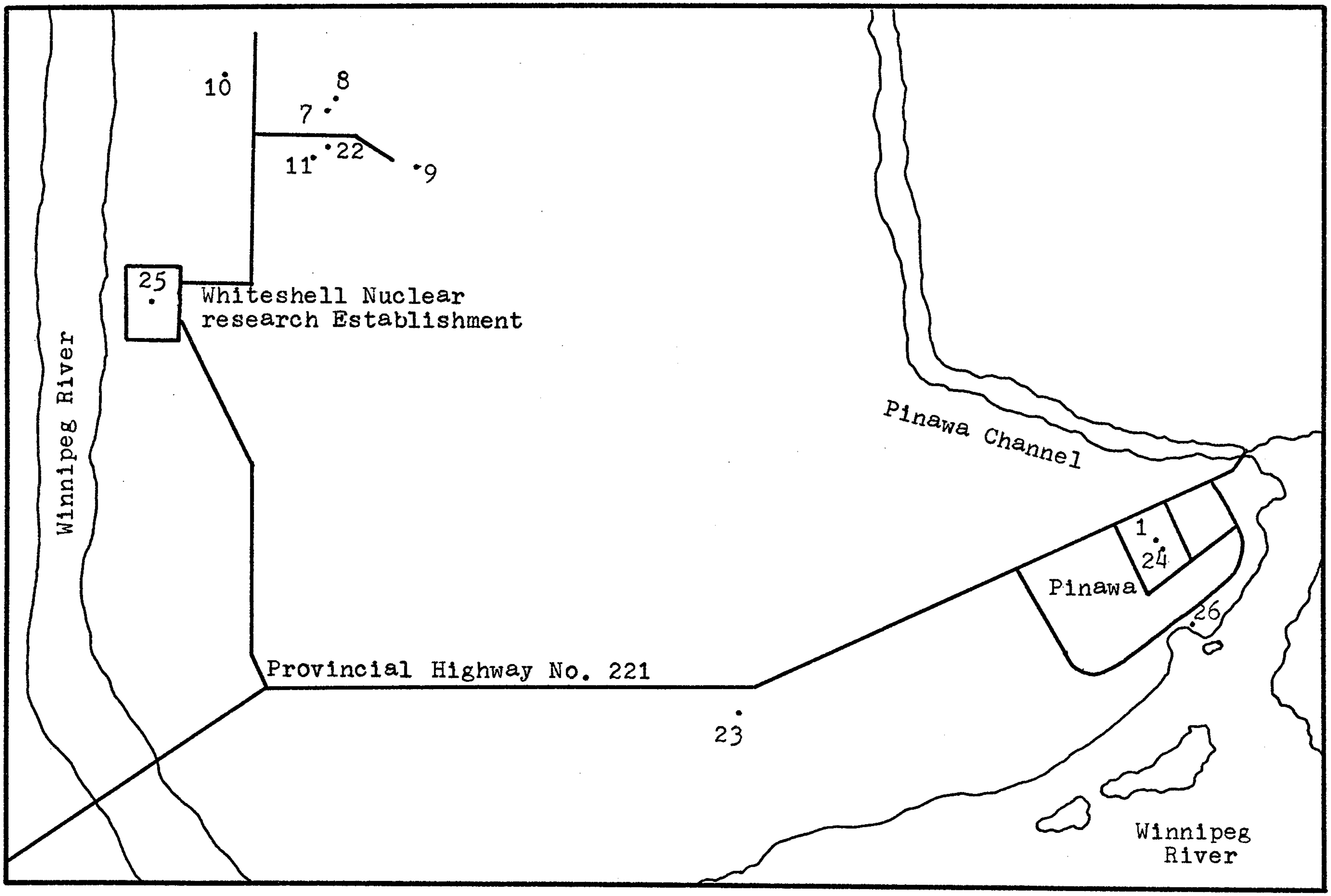
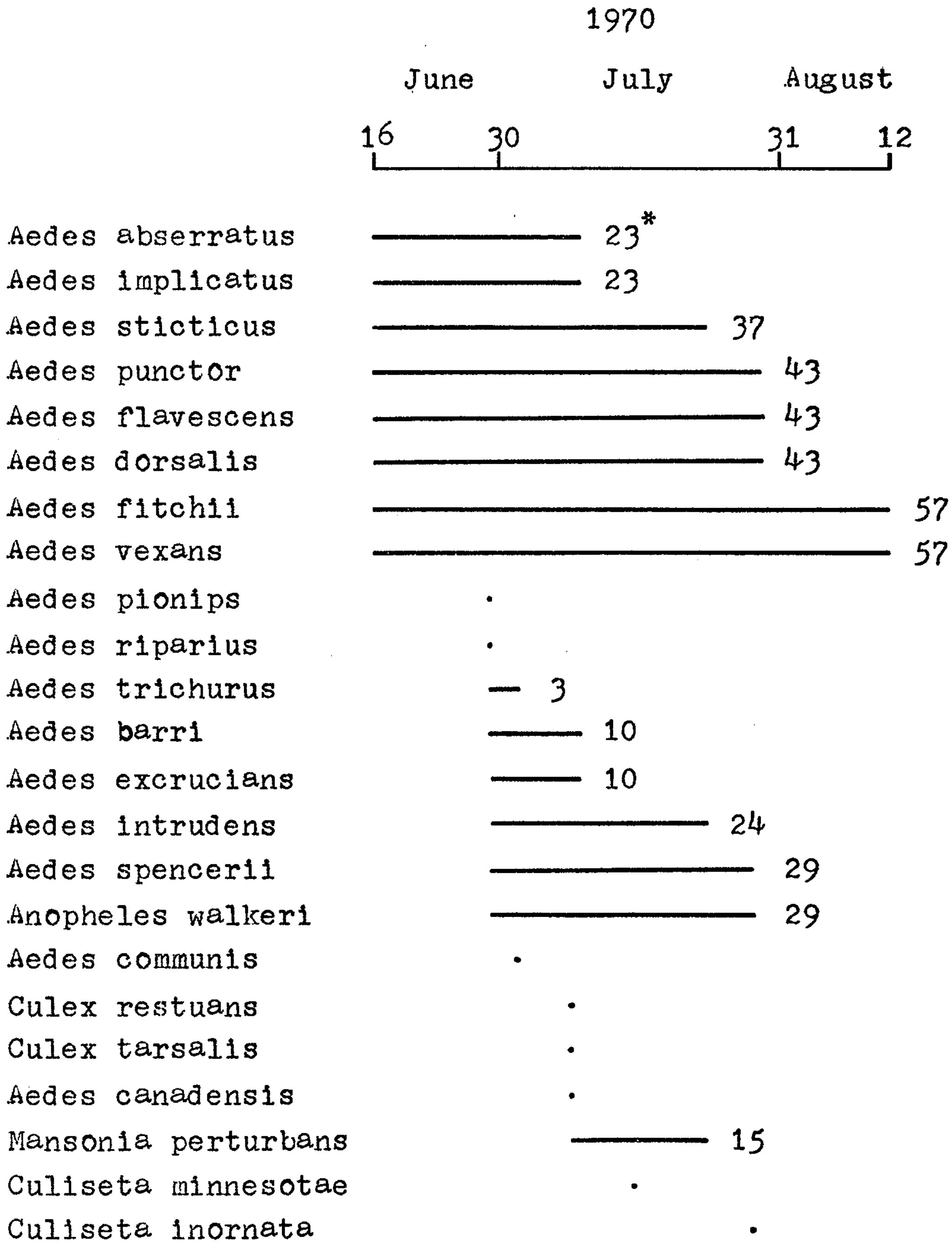

10
8
7
22
11
9
25
Whiteshell Nuclear research Establishment
Winnipeg River
Pinawa Channel
1
24
Pinawa
26
Provincial Highway No. 221
23
Winnipeg River

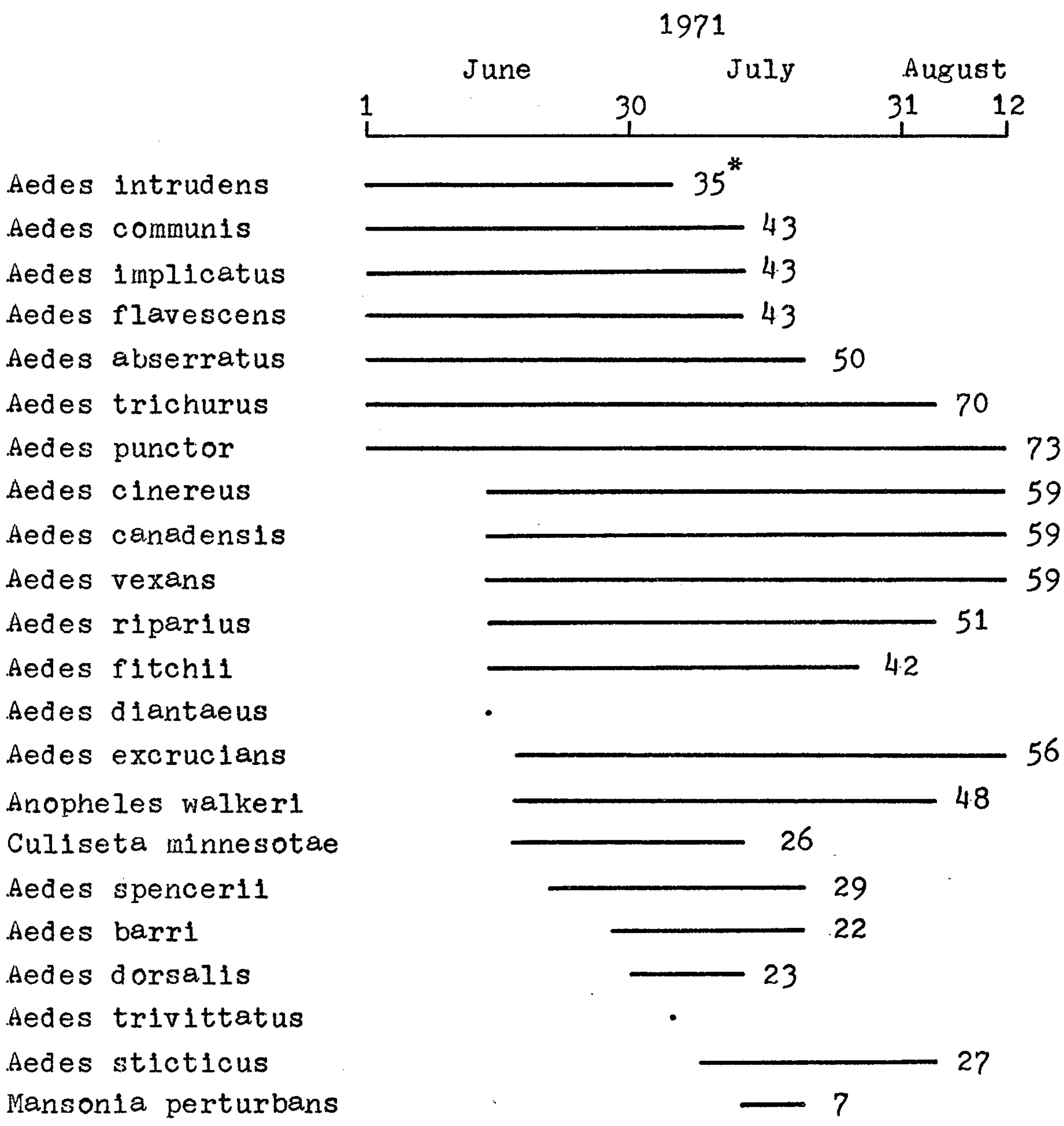
Figure 26. Seasonal distribution and estimated maximum longevity in days of species of adult female mosquitoes for 1970.



* = number of days between first and last trapping

Figure 26

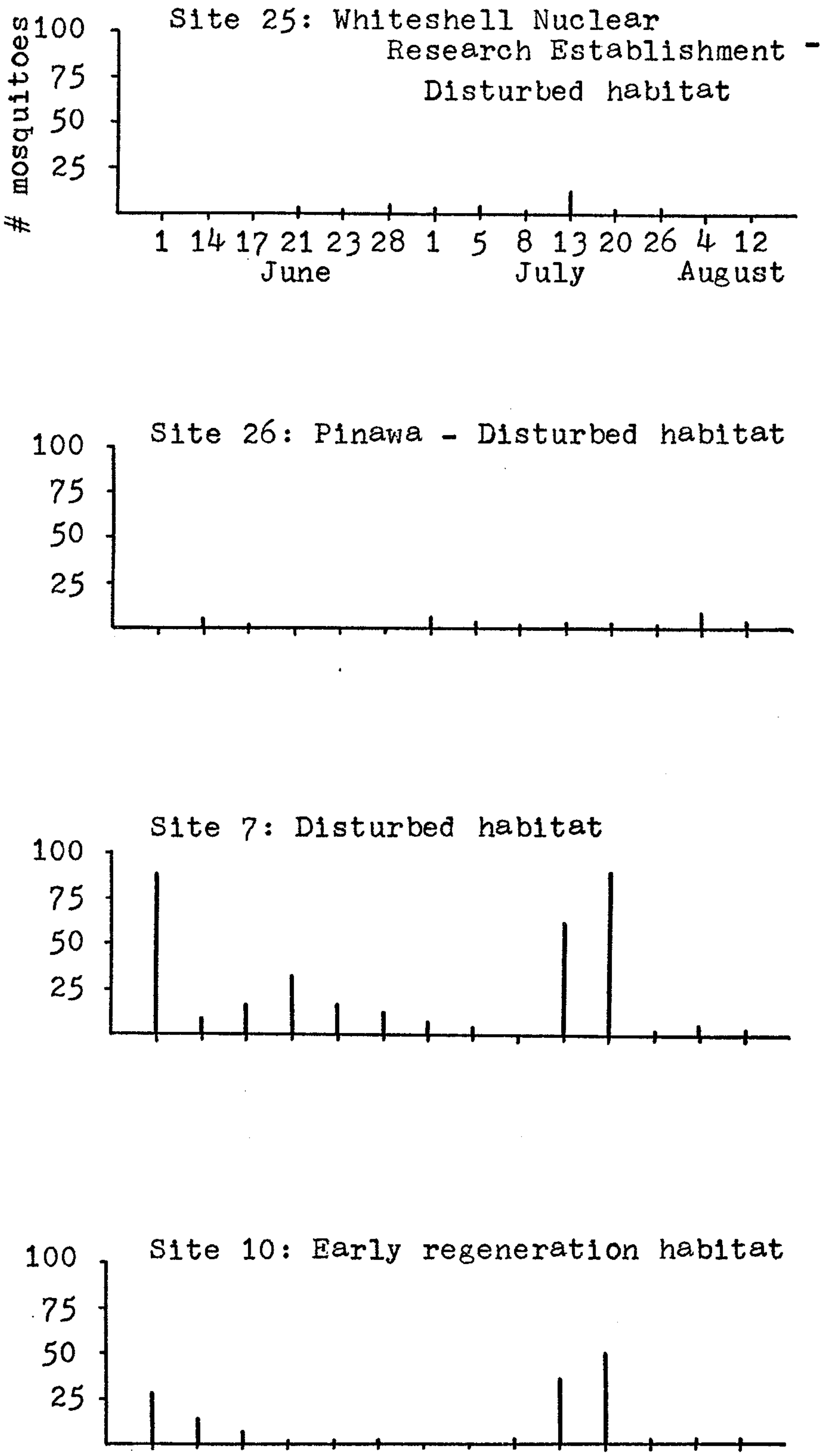
Figure 27. Seasonal distribution and estimated maximum longevity in days of species of adult female mosquitoes for 1971.



* = number of days between first and last trapping

Figure 27

Figure 28. Numbers of mosquitoes trapped each trapping evening and the mean and variance of the total numbers trapped on all trapping evenings in each of seven trapping stations representative of five habitat types.



Site 25: $n = 14$, $\bar{x} = 2.4$, $s^2 = 10.9$

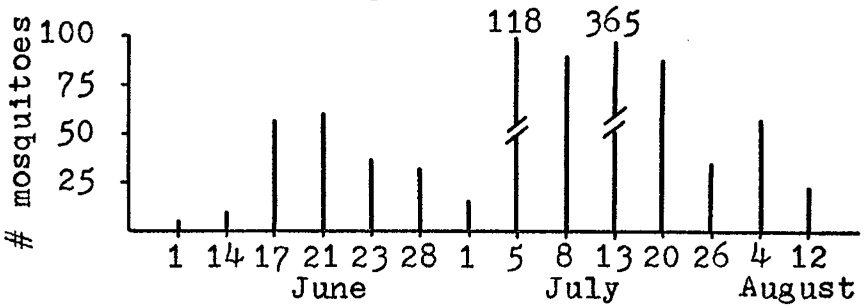
Site 26: $n = 14$, $\bar{x} = 3.1$, $s^2 = 8.3$

Site 7: $n = 14$, $\bar{x} = 25.5$, $s^2 = 911.0$

Site 10: $n = 14$, $\bar{x} = 10.9$, $s^2 = 249.0$

Figure 28

Site 8: Poplar habitat

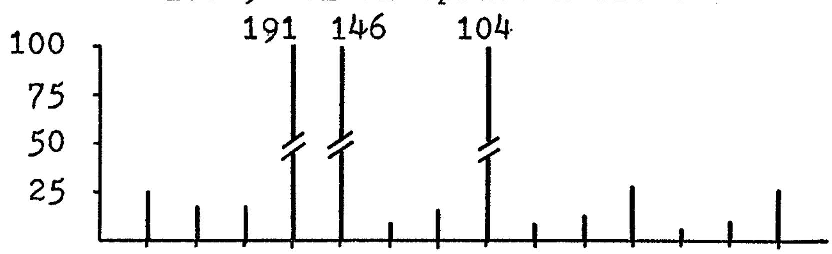


$n = 14$

$\bar{x} = 71.9$

$s^2 = 8163.0$

Site 9: Black spruce habitat

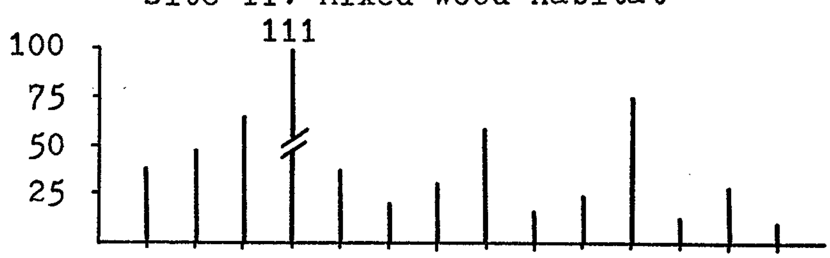


$n = 14$

$\bar{x} = 44.1$

$s^2 = 3448.0$

Site 11: Mixed wood habitat



$n = 14$

$\bar{x} = 41.4$

$s^2 = 784.9$

Figure 28 (continued)

Figure 29. Number of mosquitoes of groups 1[a], 2[b] and 3[c] collected and the time required to catch 25 mosquitoes throughout the 1971 season.

---

a = group 1: _Aedes communis_
abserratus
intrudens
punctor
trichurus
excrucians
fitchii
riparius
flavescens
spencerii
Anopheles earlei

b = group 2: _Aedes sticticus_
dorsalis
vexans
cinereus

c = group 3: _Mansonia perturbans_

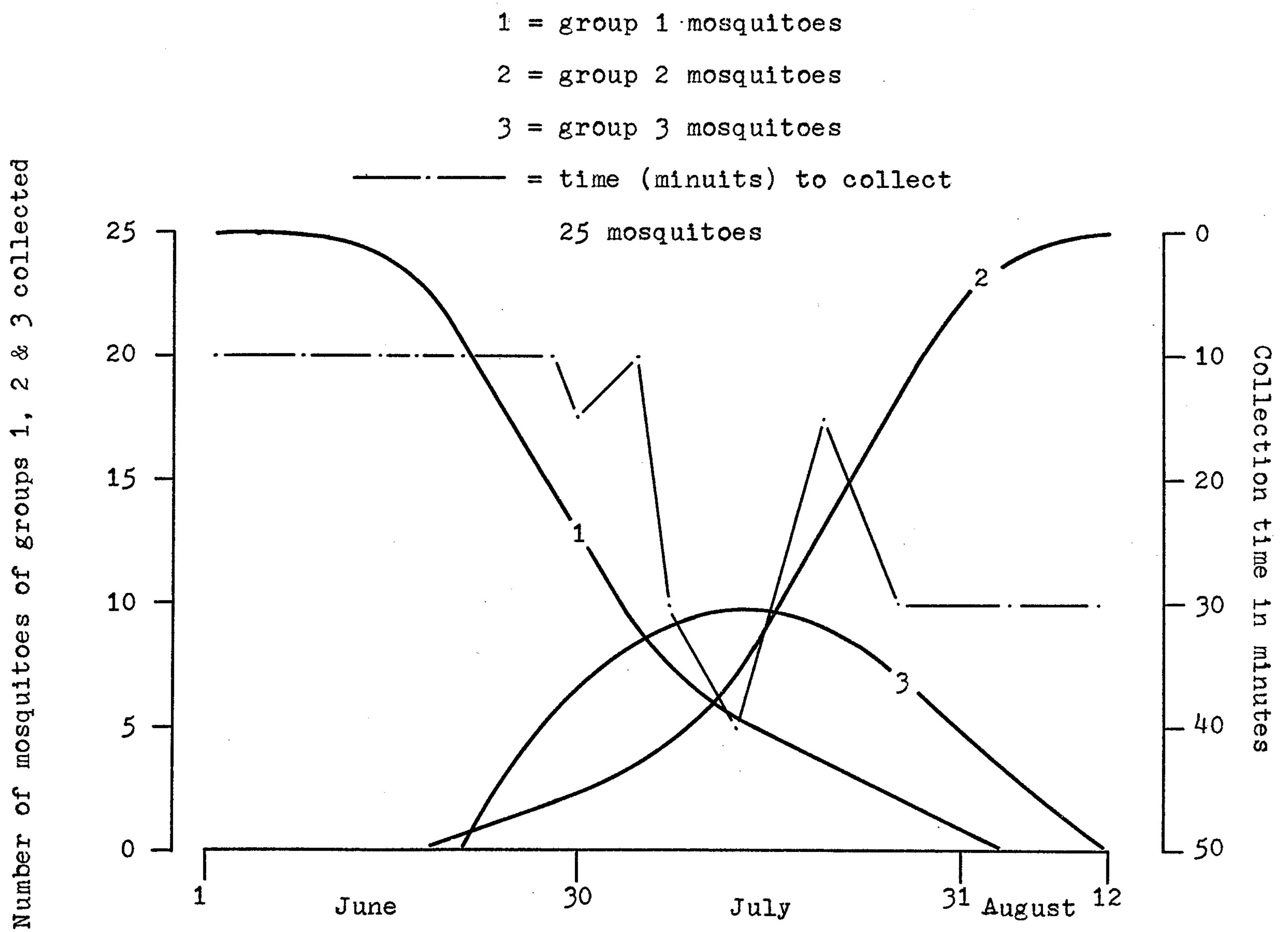

1 = group 1 mosquitoes
2 = group 2 mosquitoes
3 = group 3 mosquitoes
= time (minuits) to collect 25 mosquitoes
Number of mosquitoes of groups 1, 2 & 3 collected
25
20
15
10
5
0
1
June
30
July
31
August
12
0
10
20
30
40
50
Collection time in minutes

Figure 29

APPENDIX A

MOSQUITO LARVAE SAMPLING DATA APRIL 29 - AUGUST 4, 1971

The following gives pool length (L) and width (W) in meters (M), pool surface area (A) and effective breeding surface area (E) in square meters (M^2), pool water temperature in degrees centigrade (T^oC) and pool water pH in addition to the number of larvae collected per dip taken from all pools sampled in each of sites 1 - 21 on all of their respective sampling dates from April 29 through to August 4, 1971.

Individual sites are grouped together according to their habitat types, with all sites classed as disturbed habitats in Tables I - XIX, early regeneration habitats Tables XX - XXIII, poplar-ash habitats Tables XXIV - XXX, black spruce habitats Tables XXXI - XXXVI and mixed wood habitats Tables XXXVII - XLVI.

Those pools marked with an asterisk were greater than 25 M^2 in effective breeding surface area and thus one or more 25 M^2 quadrats was sampled from them. A footnote gives an estimate of the total effective breeding surface area of such pools.

APPENDIX A - TABLE II

Site 3: Disturbed habitat Date sampled: 3-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	5.0	5.0	25.0	25.0	9	5.5	0 4 8 8 10 25 26 14 5 11 1 5 3 5 16 9 27 25 18 9 58 39 58 15 24
2	7.0	3.0	21.0	21.0	10	5.5	5 3 20 38 85 240 224 340 54 127 64 47 125 240 30 5 19 10 7 28 270
3	1.0	1.0	1.0	1.0	13	5.5	200
4	1.0	1.0	1.0	1.0	11	5.5	0
5	3.0	1.0	3.0	3.0	12	5.5	10 18 88
6	6.0	0.4	2.4	2.4	13	5.5	6 120 700
7	2.0	1.0	2.0	2.0	11	5.5	31 182
8	1.0	1.0	1.0	1.0	12	5.5	86
9	3.0	3.0	9.0	9.0	15	5.5	3 38 48 53 11 60 11 16 45
10	5.0	3.0	15.0	15.0	13	5.5	7 5 0 4 0 0 3 1 1 1 2 2 0 0 1
11	3.0	3.0	9.0	9.0	7	5.5	6 1 14 0 1 1 1 10 1
12	6.0	3.0	18.0	18.0	7	5.5	2 0 0 3 4 3 1 0 2 2 2 0 0 1 3 1 1 2

APPENDIX A - TABLE III

Site 3: Disturbed habitat Date sampled: 31-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	5.0	4.0	20.0	20.0	11	5.5	0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 1 0
2	dry						
3	dry						
4	1.0	1.0	1.0	1.0	10	5.5	0
5	dry						
6	dry						
7	dry						
8	dry						
9	dry						
10	1.0	1.0	1.0	1.0	19	5.5	180
11	dry						
12	1.0	1.0	1.	1.	20	5.5	130

APPENDIX A - TABLE IV

Site 3: Disturbed habitat Date sampled: 23-VI-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	2.0	2.0	4.0	4.0	14	5.5	0 0 0 0
2	dry						
3	dry						
4	dry						
5	dry						
6	dry						
7	dry						
8	dry						
9	dry						
10	dry						
11	dry						
12	dry						

APPENDIX A - TABLE V

Site 3: Disturbed habitat Date sampled: 4-VIII-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	5.0	2.0	10.0	10.0	28	5.5	63 3 16 11 31 51 16 15 41 10
2	dry						
3	dry						
4	dry						
5	dry						
6	dry						
7	dry						
8	dry						
9	dry						
10	dry						
11	dry						
12	dry						

APPENDIX A - TABLE VI

Site 7: Disturbed habitat   Date sampled: 6-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	2.0	1.0	2.0	2.0	28	5.5	3 24
2	2.0	2.0	4.0	4.0	23	5.5	1 1 0 1
3	1.0	1.0	1.0	1.0	27	5.5	0
4	5.0	2.0	10.0	10.0	26	5.5	1 0 0 0 0 0 0 0 0 0
5	3.0	1.0	3.0	3.0	24	5.5	20 24 25
6	25.0	1.0	25.0	25.0	21	5.0	5 1 7 2 4 0 3 0 1 0 2 3 12 1 0 1 0 1 2 1 5 1 1 1 2
7*	5.0	5.0	25.0	25.0	28	5.5	0 2 1 1 0 0 0 1 1 6 0 1 1 1 1 2 2 4 0 1 2 2 1 1 5
8**	5.0	5.0	25.0	25.0	20	5.5	0 2 0 2 2 6 1 3 3 1 1 1 2 4 3 10 2 4 2 3 3 1 1 4
9	10,0	1.0	10.0	10.0	23	5.5	6 8 10 11 5 10 26 8 50 45
10	2.0	0.5	1.0	1.0	24	5.5	90
11	2.0	1.0	2.0	2.0	23	5.5	16 5

* Estimated effective breeding surface area = 100 M^2; ** 400 M^2

APPENDIX A - TABLE VII

Site 7: Disturbed habitat   Date sampled: 31-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	dry						
2	dry						
3	dry						
4	dry						
5	dry						
6	25.0	1.0	25.0	25.0	22	5.5	0 0 1 3 7 8 0 0 0 1 1 1 4 5 0 0 0 3 1 0 0 1 4 4 4
7	dry						
8	dry						
9	dry						
10	dry						
11	dry						

APPENDIX A - TABLE VIII

Site 15: Disturbed Habitat Date sampled: 19-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	8	5.5	0 1 1 2 0 0 0 0 1 1 2 2 0 0 0 2 0 1 1 2 2 0 1 1 2
1*	5.0	5.0	25.0	25.0	8	5.5	2 3 3 1 1 0 0 1 0 3 3 0 1 1 1 1 2 1 0 3 2 2 2 5 6
1*	5.0	5.0	25.0	25.0	8	5.5	1 1 0 0 0 1 1 0 1 2 0 1 1 2 2 3 4 4 5 2 4 0 0 0 1
1*	5.0	5.0	25.0	25.0	8	5.5	0 1 0 0 0 2 4 0 0 0 0 0 2 2 2 1 1 3 3 4 1 2 3 3 0

* Estimated effective breeding surface area = 326 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE IX

Site 15: Disturbed habitat Date sampled: 9-VI-71

Pool #	L	W	A	E	T$^{\circ}$C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	12	5.5	0 1 0 0 1 0 0 1 0 0 0 0 0 0 2 2 4 5 0 0 0 0 0 0 2
1*	5.0	5.0	25.0	25.0	12	5.5	5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	12	5.5	0 0 0 0 0 0 0 7 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 1 0
2^{+}	5.0	1.0	5.0	5.0	12	5.5	0 0 0 0 0

* Estimated effective breeding surface area = 80 M^2 (3 - 25 M^2 quadrats sampled)

$^{+}$Pool remaining after large pool (326 M^2) has dried.

APPENDIX A - TABLE X

Site 16: Disturbed habitat   Date sampled: 19-V-71

Pool #	L	W	A	E	T^0C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	12	5.5	0 0 0 0 0 0 3 3 3 0 0 1 0 0 0 1 1 1 2 3 0 1 3
2**	5.0	5.0	25.0	25.0	17	5.5	0 1 0 0 2 0 0 1 1 1 1 2 2 3 0 0 0 4 1 0 0 2 2 1 3
3***	5.0	5.0	25.0	25.0	18	5.5	0 0 0 0 1 1 2 2 8 0 1 0 1 0 0 2 0 0 0 0 2 2 3 0 0
4****	5.0	5.0	25.0	25.0	21	5.5	0 0 0 0 0 0 1 1 3 7 0 0 0 2 0 2 0 0 1 1 0 0 0 1 1

Estimated effective breeding surface area: * = 40 M^2; ** = 400 M^2; *** = 75 M^2; **** = 600 M^2

APPENDIX A - TABLE XI

Site 16: Disturbed habitat Date sampled: 9-VI-71

Pool #	L	W	A	E	T ^{o}C	pH	# Larvae/ dip
1	5.0	3.0	15.0	15.0	13	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2*	5.0	5.0	25.0	25.0	16	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
							0 0 0 0 0
3**	5.0	5.0	25.0	25.0	15	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
							0 0 0 0 0
4***	5.0	5.0	25.0	25.0	16	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
							0 0 0 0 0

Estimated effective breeding surface area: * = 400 M^2; ** = 40 M^2; *** = 100 M^2

APPENDIX A - TABLE XIII

Site 19: Disturbed habitat   Date sampled: 20-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	9	5.5	0 3 0 2 1 1 2 2 3 4 5 0 3 0 0 1 0 3 1 7 0 1 2 2 3
1 *	5.0	5.0	25.0	25.0	9	5.5	3 3 4 5 8 3 2 5 1 1 2 2 0 0 3 0 1 2 3 3 3 5 5 6 1
1 *	5.0	5.0	25.0	25.0	9	5.5	3 3 2 1 6 1 1 2 2 3 4 6 7 0 1 1 3 3 3 1 4 7 10 2 3
1 *	5.0	5.0	25.0	25.0	9	5.5	3 3 2 1 1 3 2 3 0 3 3 3 4 4 6 6 6 7 1 4 6 6 0 0 3

* Estimated effective breeding surface area = 750 M^2 (4 - 25 M^2 quadrats sampled)

Site 19: Disturbed habitat Date sampled: 9-VI-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	22	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	22	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	22	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	22	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

* Estimated effective breeding surface area = 100 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE XV

Site 19: Disturbed habitat Date sampled: 23-VI-71

Pool #	L	W	A	E	T^{o}C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	15	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1 *	5.0	5.0	25.0	25.0	15	5.5	0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1 *	5.0	5.0	25.0	25.0	15	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1 *	5.0	5.0	25.0	25.0	15	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

* Estimated effective breeding surface area = 100 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE XVI

Site 19: Disturbed habitat　　　　Date sampled: 4-VIII-71

Pool #	L	W	A	E	T^oC	pH	# Larvae/dip
1	5.0	5.0	25.0	25.0	28	5.5	0 0 0 1 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 2 0 0 1 0 2

APPENDIX A - TABLE XVII

Site 20: Disturbed habitat   Date sampled: 25-V-71

Pool #	L	W	A	E	T^0C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	13	5.5	1 1 1 1 0 0 0 0 1 0 4 1 1 3 0 6 1 2 5 0 0 0 1 1 1
1*	5.0	5.0	25.0	25.0	13	5.5	3 3 5 7 10 13 2 1 0 3 0 0 2 1 1 2 2 2 3 3 4 5 6 7 1
1*	5.0	5.0	25.0	25.0	13	5.5	6 0 5 1 0 5 0 0 0 0 0 0 0 1 2 2 2 7 1 5 1 1 4 3 5
1*	5.0	5.0	25.0	25.0	13	5.5	8 1 1 2 3 3 3 3 1 5 0 2 10 1 2 0 0 0 1 1 1 1 1 3 4

* Estimated effective breeding surface area = 75,000 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE XVIII

Site 20: Disturbed habitat — Date sampled: 9-VI-71

Pool #	L	W	A	E	T^{o}C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	14	5.5	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 1 0
1*	5.0	5.0	25.0	25.0	14	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	14	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0
1*	5.0	5.0	25.0	25.0	14	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

* Estimated effective breeding surface area = 50,000 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE XIX

Site 20: Disturbed habitat Date sampled: 23-VI-71

Pool #	L	W	A	E	T^{o}C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	15	5.5	0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 2 2 6 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	15	5.5	1 1 0 8 0 0 2 3 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	15	5.5	1 0 0 2 0 1 2 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 3 3 0
1*	5.0	5.0	25.0	25.0	15	5.5	0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 1

* Estimated effective breeding surface area = 25,000 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE XX

Site 6: Early regeneration Habitat Date sampled: 5-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	5.0	3.0	15.0	15.0	21	5.5	2 0 0 1 1 1 0 0 0 1 1 2 2 2 1
2	8.0	2.0	16.0	16.0	23	5.5	15 8 21 7 2 10 8 12 7 8 10 3 13 7 4 4
3*	5.0	5.0	25.0	25.0	23	5.5	1 0 0 1 0 0 2 0 0 4 0 0 0 0 0 5 5 2 1 0 5 1 4 5 5
4	5.0	5.0	25.0	25.0	24	5.5	1 1 2 0 1 0 0 1 0 0 1 2 0 1 0 0 2 1 0 0 0 2 2 2 2
5	4.0	4.0	16.0	16.0	23	5.5	2 2 0 0 0 0 0 0 0 2 1 1 1 1 0 0
6	4.0	4.0	16.0	16.0	27	5.5	1 2 1 0 1 1 4 5 0 1 2 1 5 3 1 3
7	3.0	1.0	3.0	3.0	28	5.5	4 16 1
8	3.0	3.0	9.0	9.0	28	5.5	5 4 4 1 0 2 1 0 1
9**	5.0	5.0	25.0	25.0	28	5.5	3 1 2 4 2 0 0 0 0 3 3 2 1 2 3 1 0 0 1 0 0 0 2 2 1
10	2.0	2.0	4.0	4.0	15	5.5	5 11 37 94

Estimated effectived breeding surface area: * = 64 M^2; ** = 60 M^2

APPENDIX A - TABLE XXI

Site 10: Early regeneration habitat   Date sampled: 11-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	6	5.5	1 0 2 0 1 2 4 2 2 5 4 3 1 1 0 0 2 0 0 1 1 1 1 2 1
2**	5.0	5.0	25.0	25.0	8	5.5	0 1 1 3 2 3 2 1 0 3 1 0 0 0 0 1 1 4 1 0 1 0 1 4 0
3	2.0	2.0	4.0	4.0	14	5.5	4 5 8 3
4	2.0	2.0	4.0	4.0	11	5.5	2 15 7 1
5***	5.0	5.0	25.0	25.0	11	5.5	2 4 2 5 0 7 3 4 0 0 4 0 1 2 3 0 1 1 1 3 0 3 5 0 0
6	3.0	2.0	6.0	6.0	13	5.5	0 0 1 2 12 11
7	2.0	2.0	4.0	4.0	11	5.5	3 9 21 10
8	2.0	2.0	4.0	4.0	11	5.5	3 3 0 1
9	3.0	2.0	6.0	6.0	14	5.5	4 4 3 1 1 1
10****	5.0	5.0	25.0	25.0	14	5.5	0 7 5 4 1 0 1 0 0 3 4 1 3 6 6 0 0 1 3 1 8 3 2 1 1

Estimated effective breeding surface area: * = 75 M^2; ** = 100 M^2; *** = 36 M^2; **** = 225 M^2

APPENDIX A - TABLE XXII

Site 10: Early regeneration habitat   Date sampled: 1-VI-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	dry						
2	dry						
3	0.6	0.6	1.2	1.2	7	5.5	2
4	dry						
5	5.0	5.0	25.0	25.0	9	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 3 5 0 0 0 0 0 1 2
6	3.0	2.0	6.0	6.0	10	5.5	0 1 1 0 0 1
7	1.0	1.0	1.0	1.0	8	5.5	0
8	2.0	1.0	2.0	2.0	9	5.5	0 2
9	3.0	2.0	6.0	6.0	9	5.5	0 0 0 0 1 1
10	5.0	5.0	25.0	25.0	9	5.5	1 0 0 0 1 0 0 1 1 1 1 2 3 0 0 0 0 1 0 3 0 0 2 0 0

APPENDIX A - TABLE XXIII

Site 10: Early regeneration habitat   Date sampled: 23-VI-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	dry						
2	dry						
3	dry						
4	dry						
5	dry						
6	1.0	1.0	1.0	1.0	22	5.5	0
7	dry						
8	3.0	1.0	3.0	3.0	22	5.5	0 0 0
9	1.0	1.0	1.0	1.0	18	5.5	1
10	dry						

APPENDIX A - TABLE XXIV

Site 5: Poplar habitat (mature) Date sampled: 5-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	1.0	1.0	1.0	1.0	8	5.5	17
2	2.0	1.0	2.0	2.0	8	5.5	4 3
3	3.0	2.0	6.0	6.0	12	5.5	4 7 11 10 7 8
4	1.0	1.0	1.0	1.0	9	5.5	7
5	1.0	1.0	1.0	1.0	10	5.5	40
6	3.0	2.0	6.0	6.0	11	5.5	3 11 14 5 1 4
7	6.0	2.0	12.0	12.0	9	5.5	7 10 12 6 1 7 10 3 5 6 2 2
8	6.0	3.0	18.0	18.0	12	5.5	6 2 2 2 2 21 8 9 7 1 2 13 8 11 4 7 0 2
9	4.0	4.0	16.0	16.0	13	5.5	20 7 23 7 9 6 4 9 17 2 2 2 10 7 7 3
10	4.0	1.0	4.0	4.0	13	5.5	8 5 7 13
11	1.0	1.0	1.0	1.0	13	5.5	18
12	3.0	1.0	3.0	3.0	14	5.5	8 0 9

APPENDIX A - TABLE XXV

Site 8: Poplar habitat (young) Date sampled: 10-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	1.0	1.0	1.0	1.0	11	5.5	5
2	2.0	1.0	2.0	2.0	11	5.5	115 8
3	4.0	3.0	12.0	12.0	11	5.5	16 5 17 6 33 29 37 11 20 30 80 20
4	1.5	1.0	1.5	1.5	11	5.5	28 7
5	2.0	2.0	4.0	4.0	12	5.5	34 175 148 115
6*	5.0	5.0	25.0	25.0	11	5.5	0 0 2 4 5 1 1 4 1 1 1 3 2 2 1 1 5 3 3 1 1 1 2 1 2
7	4.0	1.0	4.0	4.0	11	5.5	8 4 10 3
8	2.0	1.0	2.0	2.0	11	5.5	49 35
9	5.0	5.0	25.0	25.0	11	5.5	54 55 135 21 2 3 8 61 27 9 130 9 125 18 16 56 23 113 7 43 1 3 91 9 31
10	24.0	0.3	7.2	7.2	11	5.5	18 31 19 13 82 10 6 175

* Estimated effective breeding surface area = 400 M^2

APPENDIX A - TABLE XXVI

Site 8: Poplar habitat (young)   Date sampled: 31-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	dry						
2	dry						
3	dry						
4	dry						
5	dry						
6	5.0	5.0	25.0	25.0	23	5.5	0 0 0 1 2 0 0 0 0 1 2 2 0 1 0 0 0 0 0 0 0 0 0 0 0
7	dry						
8	dry						
9	dry						
10	dry						

APPENDIX A - TABLE XXVII

Site 18: Ash habitat — Date sampled: 20-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	15.0	1.0	15.0	15.0	7	5.5	32 3 9 3 11 3 6 6 3 5 8 0 6 6 11
2	5.0	1.0	5.0	5.0	7	5.5	2 3 2 4 5
3	5.0	2.0	10.0	10.0	8	5.5	3 6 4 0 4 0 3 3 3 4
4	9.0	2.0	18.0	18.0	9	5.5	0 0 1 1 1 1 0 1 1 3 4 6 6 2 0 1 2 0
5	4.0	2.0	8.0	8.0	10	5.5	3 2 0 1 0 0 1 3
6	6.0	2.0	12.0	12.0	9	5.5	0 1 1 3 0 0 1 1 1 3 2 1
7	10.0	1.0	10.0	10.0	9	5.5	4 1 1 0 2 0 0 0 1 2
8	8.0	2.0	16.0	16.0	9	5.5	1 1 0 0 0 0 0 0 1 1 1 1 0 0 1 0
9	6.0	2.0	12.0	12.0	10	5.5	0 0 2 3 1 4 1 1 1 0 2 3
10	1.0	1.0	1.0	1.0	10	5.5	1

APPENDIX A - TABLE XXVIII

Site 18: Ash habitat Date sampled: 9-VI-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	dry						
2	3.0	1.0	3.0	3.0	15	5.5	0 0 0
3	5.0	1.0	5.0	5.0	18	5.5	0 0 0 0 0
4	10.0	1.0	10.0	10.0	17	5.5	0 0 0 0 0 0 0 0 0 0
5	4.0	2.0	8.0	8.0	18	5.5	0 0 0 0 0 0 0 0
6	4.0	4.0	16.0	16.0	19	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7	8.0	1.0	8.0	8.0	17	5.5	0 0 0 0 0 0 0 0
8*	5.0	5.0	25.0	25.0	16	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
							0 0 0 0 0
9	8.0	2.0	16.0	16.0	16	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
10	1.0	1.0	1.0	1.0	17	5.5	0

* Estimated effective breeding surface area = 30 M^2

APPENDIX A - TABLE XXIX

Site 21: Poplar habitat (mature) Date sampled: 25-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	15	5.5	0 2 0 1 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	15	5.5	2 3 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 2 0 0 0 1 0 0 0
1*	5.0	5.0	25.0	25.0	15	5.5	0 0 1 1 1 0 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	15	5.5	0 0 0 1 1 0 0 0 0 0 1 0 0 0 0 1 1 0 0 0 0 0 0 1 1

* Estimated effective breeding surface area = 200 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE XXX

Site 21: Poplar habitat (mature)   Date sampled: 9-VI-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	19	5.0	0 0 3 0 0 0 0 0 5 6 35 2 0 0 0 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	19	5.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	19	5.0	0 0 0 0 0 0 0 0 0 0 22 0 0 12 0 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	19	5.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

* Estimated effective breeding surface area = 150 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE XXXI

Site 9: Black spruce habitat Date sampled: 10-V-71

Pool #	L	W	A	E	T^oC	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	7	5.5	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2	1.0	1.0	1.0	1.0	3	5.5	0
3	2.0	2.0	4.0	4.0	8	5.5	0 0 0 0
4**	5.0	5.0	25.0	25.0	9	5.5	0 0 4 2 1 3 0 5 11 2 0 1 1 0 0 5 1 3 5 2 3 3 5 0 17
5	5.0	1.0	5.0	5.0	7	5.5	2 1 0 0 0
6	2.0	2.0	4.0	4.0	8	5.5	2 6 8 6
7	10.0	2.0	20.0	20.0	6	5.5	1 0 2 0 1 1 0 1 0 1 1 12 1 0 125 9 1 1 3 0
8	2.0	1.0	2.0	2.0	8	5.5	21 3
9	4.0	1.0	4.0	4.0	6	5.5	4 7 1 16
10	2.0	1.0	2.0	2.0	6	5.5	3 2
11	1.0	1.0	1.0	1.0	4	5.5	13

Site 9: Black spruce habitat   Date sampled: 10-V-71

Pool #	L	W	A	E	T^oC	pH	# Larve/dip
12	3.0	2.0	6.0	6.0	7	5.0	3 8 6 1 1 1
13	1.0	1.0	1.0	1.0	7	5.0	3

Estimated effective breeding surface area: * = 100 M^2; ** = 55 M^2

Site 9: Black spruce habitat   Date sampled: 1-VI-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	dry						
2	dry						
3	dry						
4	dry						
5	dry						
6	dry						
7	dry						
8	dry						
9	2.0	1.0	2.0	2.0	7	4.5	5 7
10	dry						
11	dry						
12	dry						

APPENDIX A - TABLE XXXIII

Site 12: Black spruce habitat   Date sampled: 12-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	3.0	3.0	9.0	9.0	4	5.0	0 0 1 0 1 0 0 0 0
2	2.0	1.0	2.0	2.0	4	5.0	0 8
3	9.0	1.0	9.0	9.0	3	5.0	0 0 5 1 1 0 5 13 17
4	6.0	1.0	6.0	6.0	6	5.0	3 0 11 1 0 1
5	1.0	1.0	1.0	1.0	5	5.0	4
6	2.0	2.0	4.0	4.0	4	5.5	0 5 4 1
7	5.0	5.0	25.0	9.0	5	5.0	4 3 1 2 3 0 2 4 2
8	3.0	2.0	6.0	6.0	5	5.0	7 15 1 5 2 7
9	2.0	2.0	4.0	4.0	4	5.0	0 0 0 1
10	4.0	4.0	16.0	16.0	5	5.0	7 13 1 1 1 3 3 9 4 3 8 0 0 5 1 3
11	3.0	3.0	9.0	9.0	4	5.0	3 2 1 7 3 0 0 3 0
12	5.0	1.0	5.0	5.0	5	5.0	6 0 26 3 1 1
13	10.0	1.0	10.0	10.0	6	5.0	0 0 20 0 0 2 3 8 16 16

APPENDIX A - TABLE XXXIV

Site 12: Black spruce habitat   Date sampled: 1-VI-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	dry						
2	dry						
3	4.0	0.8	3.2	3.2	7	4.5	1 2 2
4	2.0	1.0	2.0	2.0	10	4.5	6 3
5	1.0	1.0	1.0	1.0	12	4.5	3
6	1.0	1.0	1.0	1.0	10	4.5	4
7	dry						
8	1.0	1.0	1.0	1.0	6	4.5	10
9	1.0	1.0	1.0	1.0	7	4.5	6
10	2.0	2.0	4.0	4.0	9	4.5	7 7 15 2
11	dry						
12	1.0	1.0	1.0	1.0	12	4.5	5
13	4.0	1.0	4.0	4.0	9	4.5	16 3 11 6

APPENDIX A - TABLE XXXV

Site 14: Black spruce habitat   Date sampled: 13-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	3.0	3.0	9.0	9.0	4	5.0	5 1 25 19 20 8 64 32 20
2	3.0	2.0	6.0	6.0	10	5.0	19 83 145 17 15 72
3	2.0	2.0	4.0	4.0	6	5.0	32 3 0 10
4	1.0	1.0	1.0	1.0	12	5.0	20
5	2.0	1.0	2.0	2.0	8	4.5	16 170
6	2.0	1.0	2.0	2.0	3	4.5	1 7
7	1.0	1.0	1.0	1.0	7	4.5	14
8	2.0	1.0	2.0	2.0	10	4.5	22 21
9	2.0	1.0	2.0	2.0	10	4.5	28 52
10	1.0	1.0	1.0	1.0	7	4.5	20
11	2.0	0.5	1.0	1.0	3	4.5	92
12	2.0	0.5	1.0	1.0	3	4.5	35

APPENDIX A - TABLE XXXVI

Site 14: Black spruce habitat   Date sampled: 2-VI-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	1.0	1.0	1.0	1.0	11	4.5	29
2	1.0	1.0	1.0	1.0	11	4.5	500
3	dry						
4	1.0	1.0	1.0	1.0	13	4.5	110
5	1.0	1.0	1.0	1.0	15	4.5	200
6	1.0	1.0	1.0	1.0	10	4.5	25
7	1.0	1.0	1.0	1.0	8	4.5	38
8	dry						
9	dry						
10	dry						
11	1.0	1.0	1.0	1.0	7	4.5	40
12	2.0	1.0	2.0	2.0	7	4.5	7 18

APPENDIX A - TABLE XXXVII

Site 1: Mixed wood habitat Date sampled: 29-IV-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	1.0	1.0	1.0	1.0	8	5.5	457
2	4.0	3.0	12.0	12.0	9	5.5	4 11 26 5 7 12 10 2 8 6 13 11
3	1.0	1.0	1.0	1.0	6	5.5	0
4	4.0	3.0	12.0	12.0	9	5.5	1 0 3 1 4 1 1 1 3 0 2 5
5	1.0	1.0	1.0	1.0	8	5.0	0
6	1.0	1.0	1.0	1.0	8	5.0	0
7	1.0	1.0	1.0	1.0	9	5.5	597
8	2.0	0.5	1.0	1.0	8	5.5	3
9*	5.0	5.0	25.0	25.0	7	5.0	4 4 8 2 10 10 7 9 3 4 8 4 6 13 8 8 20 14 7 4 12 3 4 4 3
10**	5.0	5.0	25.0	25.0	11	5.5	2 3 0 1 1 2 1 5 8 2 1 0 0 3 13 5 8 6 6 3 1 0 1 0 1
11	2.0	1.0	2.0	2.0	10	5.5	10 13
12	2.0	2.0	4.0	4.0	9	5.0	4 19 5 6

Site 1: Mixed wood habitat   Date sampled: 29-IV-71

Pool #	L	W	A	E	T^0C	pH	# Larvae/dip
13***	5.0	5.0	25.0	25.0	11	5.5	1 300 250 17 235 70 75 130 37 27 55 25 100 33 11 9 350 1 0 200 0 14 6 70 4
14	4.0	1.0	4.0	4.0	11	5.5	4 200 250 28
15****	5.0	5.0	25.0	25.0	11	5.5	4 5 7 4 9 6 9 6 9 9 3 3 6 10 4 17 16 6 4 4 2 2 0 12 10

Estimated effective breeding surface area: * = 1000 M^2; ** = 50 M^2; *** = 30 M^2; **** = 45 M^2

APPENDIX A - TABLE XXXVIII

Site 1: Mixed wood habitat Date sampled: 31-V-71

Pool #	L	W	A	E	T^oC	pH	# Larvae/dip
1	dry						
2	4.0	1.0	4.0	4.0	10	5.5	3 0 0 2
3	1.0	1.0	1.0	1.0	10	5.5	3
4	1.0	1.0	1.0	1.0	10	5.5	3
5	dry						
6	dry						
7	2.0	0.5	1.0	1.0	6	5.5	1
8	1.0	1.0	1.0	1.0	9	5.5	9
9	5.0	5.0	25.0	25.0	11	5.5	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
10	2.0	2.0	4.0	4.0	13	5.5	0 0 0 0
11	dry						
12	dry						
13	dry						

APPENDIX A - TABLE XXXVIII (continued)

Site 1: Mixed wood habitat   Date sampled: 31-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
14	dry						
15	dry						

APPENDIX A - TABLE XXXIX

Site 4: Mixed wood habitat Date sampled: 4-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1	6.0	2.0	12.0	12.0	6	5.5	2 0 1 3 4 2 2 3 3 0 0 0
2	4.0	2.0	8.0	8.0	7	5.0	9 10 10 9 0 5 4 10
3*	5.0	5.0	25.0	25.0	7	5.5	11 16 8 3 10 15 5 9 9 14 7 69 21 8 6 5 9 4 5 4 3 5 6 4 4
4	3.0	2.0	6.0	6.0	10	5.5	4 3 7 3 0 2
5	6.0	4.0	24.0	24.0	10	5.0	4 15 3 1 6 2 3 3 4 4 14 2 5 6 3 0 18 1 2 5 36 18 2 10
6	3.0	3.0	9.0	9.0	13	5.5	4 4 7 2 18 1 11 8 1
7**	5.0	5.0	25.0	25.0	11	5.5	36 68 80 39 18 29 29 14 17 18 1 14 3 12 9 4 24 11 12 14 11 31 16 13 8
8	3.0	1.0	3.0	3.0	17	5.0	4 0 3
9	2.0	2.0	4.0	4.0	7	5.5	5 2 18 5
10	1.0	1.0	1.0	1.0	9	5.5	18

Estimated effective breeding surface area: * = 60 M^2; ** = 36 M^2

APPENDIX A - TABLE XL

Site 4: Mixed wood habitat Date sampled: 31-V-71

Pool #	L	W	A	E	T^{o}C	pH	# Larvae/dip
1	dry						
2	dry						
3	1.0	1.0	1.0	1.0	18	5.5	0
4	dry						
5	dry						
6	dry						
7	dry						
8	dry						
9	dry						
10	dry						

APPENDIX A - TABLE XLI

Site 11: Mixed wood habitat Date sampled: 11-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	26	5.5	12 7 10 17 17 19 17 10 17 17 23 7 18 46 44 10 4 18 14 32 9 14 3 14 4
2	4.0	2.0	8.0	8.0	8	5.5	5 7 9 17 4 9 2 7
3	2.0	2.0	4.0	4.0	12	5.5	4 39 5 1
4	3.0	3.0	9.0	9.0	11	5.5	13 10 10 20 13 10 23 8 11
5	2.0	2.0	4.0	4.0	12	5.5	9 5 7 2
6**	5.0	5.0	25.0	25.0	12	5.5	6 7 1 8 5 0 5 1 8 2 8 10 6 1 4 0 4 1 5 17 1 3 7 3 16
7	5.0	5.0	25.0	25.0	9	5.5	57 0 0 13 28 2 3 20 23 2 7 1 4 0 2 60 17 20 3 2 29 13 5 4 7
8	5.0	2.0	10.0	10.0	13	5.5	2 0 3 2 0 4 4 3 2 21
9	2.0	2.0	4.0	4.0	12	5.5	11 7 3 4
10	1.0	1.0	1.0	1.0	6	5.5	15

Estimated effective breeding surface area: * = 250 M^2; ** = 30 M^2

APPENDIX A - TABLE XLII

Site 11: Mixed wood habitat   Date sampled: 31-V-71

Pool #	L	W	A	E	T°C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	20	5.5	1 1 4 5 0 2 1 0 0 1 2 3 5 0 0 0 0 3 1 0 0 1 3 6 7
2	2.0	2.0	4.0	4.0	15	5.5	10 13 13 32
3	dry						
4	dry						
5	1.0	1.0	1.0	1.0	16	5.5	15
6	dry						
7	dry						
8	dry						
9	dry						
10	1.0	1.0	1.0	1.0	14	5.5	18

* Estimated effective breeding surface area = 250 M^2

APPENDIX A - TABLE XLIII

Site 13: Mixed wood habitat　　　　Date sampled: 13-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	10	5.0	7 7 16 17 10 5 10 18 14 11 8 6 20 15 7 5 5 15 10 13 16 16 10
1*	5.0	5.0	25.0	25.0	9	5.0	19 5 22 4 9 5 2 9 18 10 9 18 5 4 2 6 12 14 14 2 5 9 12 6 12 12
1*	5.0	5.0	25.0	25.0	10	5.0	4 18 40 11 12 22 60 11 30 32 22 12 35 12 19 11 12 13 11 10 7 12 37 7 13
1*	5.0	5.0	25.0	25.0	12	5.0	16 17 21 11 10 12 16 12 25 11 16 23 25 13 12 10 22 32 11 18 8 10 11 12 38
2	10.0	2.0	20.0	20.0	14	5.0	15 18 6 14 5 8 6 5 11 16 5 8 19 10 11 12 12 20 2 4

* Estimated effective breeding surface area = 500 M^2 (4 - 25 M^2 quadrats sampled)

APPENDIX A - TABLE XLIV

Site 13: Mixed wood habitat Date sampled: 2-VI-71

Pool #	L	W	A	E	T^0C	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	17	4.5	0 0 0 1 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
1*	5.0	5.0	25.0	25.0	21	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0
2	5.0	2.0	10.0	10.0	22	5.0	2 5 2 0 2 0 2 0 0 0
3+	3.0	3.0	9.0	9.0	17	5.0	0 0 0 0 0 0 0 2 0
4+	1.0	1.0	1.0	1.0	19	4.5	0

* Estimated effective breeding surface area = 100 M^2

+ Two of many pools remaining after large pool (500 M^2) has dried.

APPENDIX A - TABLE XLV

Site 17: Mixed wood habitat Date sampled: 19-V-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1*	5.0	5.0	25.0	25.0	19	5.5	0 1 1 2 3 0 0 0 0 0 2 3 3 1 2 4 2 0 0 0 1 1 2 0 2
2**	5.0	5.0	25.0	25.0	20	5.5	0 1 2 2 1 0 2 0 0 0 0 1 2 1 0 0 3 0 2 3 3 0 0 1 2
3***	5.0	5.0	25.0	25.0	20	5.5	1 4 5 6 12 16 0 3 3 3 11 2 4 4 7 8 1 4 12 2 6 4 5 6 12
4****	5.0	5.0	25.0	25.0	21	5.5	1 2 2 4 6 0 1 1 2 4 4 5 1 4 2 1 1 3 5 1 3 3 4 2 0

Estimated effective breeding surface area: * = 100 M^2; ** = 200 M^2; *** = 100 M^2; **** = 100 M^2

APPENDIX A - TABLE XLVI

Site 17: Mixed wood habitat Date sampled: 9-VI-71

Pool #	L	W	A	E	$T^{o}C$	pH	# Larvae/dip
1	5.0	5.0	25.0	25.0	15	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2	5.0	5.0	25.0	25.0	16	5.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3	dry						
4	2.0	2.0	4.0	4.0	17	5.5	0 0 0 0

APPENDIX B

MOSQUITO LARVAE IDENTIFICATION DATA

APRIL 29 - AUGUST 4, 1971

The following gives the number of each species of larvae identified, and the total number of larvae identified from all pools in all sites sampled on their respective sampling dates from April 29 to August 4, 1971. Sites are grouped according to their habitat type, with all disturbed habitats in Tables I - XV, early regeneration habitats Tables XVI - XIX, poplar-ash habitats Tables XX - XXV, black spruce habitats Tables XXVI - XXXIV and mixed wood habitats Tables XXXV - XLIII.

When sites are sampled for the second or subsequent times, only those pools containing water are listed. Those pools which contained water but no larvae are marked with a single asterisk; those marked with a double asterisk contained larvae which were not identified. After the initial sampling, when most pools were dry, larvae were identified from pools not previously sampled.

APPENDIX B -TABLE I

Site 2: Disturbed habitat   Date sampled: 3-V-71

	Pool #									
Species	1	2	3	4	5	6	7	8	9	10
Aedes communis	4									
Aedes dorsalis			1							
Aedes fitchii		4								
Aedes implicatus	5	4	6	9	10	9	9	4	10	9
Aedes riparius	1	1	3	1						
Aedes spencerii		1				1	1			1
Total	10	10	10	10	10	10	10	4	10	10

APPENDIX B - TABLE II

Site 3: Disturbed habitat   Date sampled: 3-V-71

	Pool #											
Species	1	2	3	4	5	6	7	8	9	10	11	12
Aedes excrucians						1						
Aedes fitchii												3
Aedes implicatus	9	10	10		9	7	10	9	10	10	10	4
Aedes intrudens						1						
Aedes riparius					1			1				3
Aedes trichurus	1					1						
Total	10	10	10	*	10	10	10	10	10	10	10	10

* No larvae present

APPENDIX B - TABLE III

Site 3: Disturbed habitat Date sampled: 31-V-71

Species	Pool # 1	10	12
Aedes excrucians	7		
Aedes vexans		12	12
Aedes cinereus	4		
Total	11	12	12

APPENDIX B - TABLE IV

Site 3: Disturbed habitat Date sampled: 4-VIII-71

	Pool #
Species	1
Aedes vexans	10
Total	10

APPENDIX B - TABLE V

Site 7: Disturbed habitat   Date sampled: 6-V-71

Species	Pool # 1	2	3	4	5	6	7	8	9	10	11
Aedes communis											5
Aedes excrucians	1				1		3	1			
Aedes fitchii		7		10		7					1
Aedes implicatus	9				4	1			10	10	1
Aedes punctor								7			
Aedes riparius		3			3	2	6	2			
Aedes spencerii					2						1
Aedes sticticus											1
Aedes trichurus							1				
Aedes cinereus											1
Total	10	10	*	10	10	10	10	10	10	10	10

* No larvae present

APPENDIX B - TABLE VI

Site 7: Disturbed habitat   Date sampled: 31-V-71

	Pool #
Species	6
Aedes canadensis	10
Total	10

APPENDIX B - TABLE VII

Site 15: Disturbed habitat Date sampled: 19-V-71

Species	Pool # 1
Aedes barri	12
Aedes canadensis	1
Aedes excrucians	17
Aedes fitchii	65
Aedes riparius	1
Aedes cinereus	4
Total	100

APPENDIX B - TABLE VIII

Site 15: Disturbed habitat Date sampled: 9-VI-71

	Pool #	
Species	1	2
Aedes vexans	17	
Aedes cinereus	1	
Culex territans	3	
Total	21	*

* No larvae present

APPENDIX B - TABLE IX

Site 16: Disturbed habitat Date sampled: 19-V-71

	Pool #			
Species	1	2	3	4
Aedes barri			2	2
Aedes canadensis			1	
Aedes cinereus	1		2	
Aedes excrucians	1	1	3	10
Aedes fitchii	23	24	13	13
Total	25	25	25	25

APPENDIX B - TABLE X

Site 19: Disturbed habitat Date sampled: 20-V-71

	Pool #
Species	1
Aedes excrucians	74
Aedes fitchii	4
Aedes riparius	17
Aedes cinereus	5
Total	100

APPENDIX B - TABLE XI

Site 19: Disturbed habitat Date sampled: 23-VI-71

	Pool #
Species	1
Culex territans	1
Total	1

APPENDIX B - TABLE XII

Site 19: Disturbed habitat   Date sampled: 4-VIII-71

	Pool #
Species	1
Anopheles earlei	1
Culex territans	6
Total	7

APPENDIX B - TABLE XIII

Site 20: Disturbed habitat Date sampled: 25-V-71

	Pool #
Species	1
Aedes barri	4
Aedes cinereus	1
Aedes excrucians	77
Aedes fitchii	3
Aedes riparius	15
Total	100

APPENDIX B - TABLE XIV

Site 20: Disturbed habitat Date sampled: 9-VI-71

Species	Pool # 1
Culiseta minnesotae	1
Total	1

APPENDIX B - TABLE XV

Site 20: Disturbed habitat   Date sampled: 23-VI-71

Species	Pool # 1
Culiseta minnesotae	2
Culex territans	34
Total	36

APPENDIX B - TABLE XVI

Site 6: Early regeneration habitat   Date samled: 5-V-71

Species	Pool #									
	1	2	3	4	5	6	7	8	9	10
Aedes canadensis				1	1					
Aedes fitchii	8	2	5	2	9	5		6	2	
Aedes implicatus	1	8	3	7		5	10	3	8	10
Aedes riparius			1							
Aedes spencerii	1		1					1		
Total	10	10	10	10	10	10	10	10	10	10

APPENDIX B - TABLE XVII

Site 10: Early regeneration habitat   Date sampled: 11-V-71

Species	Pool # 1	2	3	4	5	6	7	8	9	10
Aedes barri						1				
Aedes communis						1				
Aedes diantaeus					2			3	2	
Aedes excrucians	2	1	2			2			3	5
Aedes implicatus			2				1	3		
Aedes intrudens	1						2			
Aedes punctor	1	4	4			1	2	1	2	2
Aedes riparius	5	1	2	10	6	2	5	3	2	
Aedes sticticus										2
Aedes trichurus	1	4			2	3			1	1
Total	10	10	10	10	10	10	10	10	10	10

APPENDIX B - TABLE XVIII

Site 10: Early regeneration habitat   Date sampled: 1-VI-71

	Pool #		
Species	3	5	10
Aedes excrucians	3	7	14
Total	3	7	14

APPENDIX B - TABLE XIX

Site 10: Early regeneration habitat   Date sampled: 23-VI-71

	Pool #
Species	9
Culex territans	2
Total	2

APPENDIX B - TABLE XX

Site 5: Poplar habitat (mature)   Date sampled: 5-V-71

	Pool #											
Species	1	2	3	4	5	6	7	8	9	10	11	12
Aedes communis					1							
Aedes implicatus	10	10	10	10	8	10	1	4	4	10	4	10
Aedes intrudens					1		9	5	6		4	
Aedes trichurus								1			2	
Total	10	10	10	10	10	10	10	10	10	10	10	10

APPENDIX B - TABLE XXI

Site 8: Poplar habitat (young)   Date sampled: 10-V-71

	Pool #									
Species	1	2	3	4	5	6	7	8	9	10
Aedes barri						3				
Aedes canadensis						1	6			
Aedes cinereus						2	1			
Aedes excrucians							1			
Aedes fitchii						4	1			
Aedes implicatus	10	10	10	10	10		1	10	10	10
Total	10	10	10	10	10	10	10	10	10	10

APPENDIX B - TABLE XXII

Site 8: Poplar habitat (young)   Date sampled: 31-V-71

Species	Pool # 6
Aedes cinereus	1
Culex territans	4
Total	5

APPENDIX B - TABLE XXIII

Site 18: Ash habitat Date sampled: 20-V-71

	Pool #									
Species	1	2	3	4	5	6	7	8	9	10
Aedes barri	2					1	5	1	10	
Aedes canadensis	3									
Aedes cinereus	1	4	8	7	1		2	6		9
Aedes diantaeus	1	1			1					
Aedes exrucians		4	2	3	8	8	3	3		1
Aedes fitchii		1								
Aedes intrudens	3					1				
Total	10	10	10	10	10	10	10	10	10	10

APPENDIX B - TABLE XXIV

Site 21: Poplar habitat (mature) Date sampled: 25-V-71

Species	Pool # 1
Aedes barri	2
Aedes cinereus	2
Aedes excrucians	7
Aedes fitchii	1
Total	12

APPENDIX B - TABLE XXV

Site 21: Poplar habitat (mature) Date sampled: 9-VI-71

	Pool #
Species	1
Aedes vexans	31
Total	31

APPENDIX B - TABLE XXVI

Site 9: Black spruce habitat Date sampled: 9-V-71

Species	Pool #												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Aedes abserratus							1	1				1	
Aedes diantaeus				3		2	4	1				2	
Aedes punctor	1			7	10	8	5	8	6	10	10	8	10
Total	1	*	*	10	10	10	10	10	6	10	10	11	10

* No larvae present

APPENDIX B - TABLE XXVII

Site 9: Black spruce habitat Date sampled: 1-VI-71

	Pool #	
Species	9	14[a]
Aedes communis		4
Aedes diantaeus	7	8
Aedes punctor	5	13
Total	12	25

[a] = Pool containing larvae which was not previously sampled (# larvae/dip not counted)

APPENDIX B -- TABLE XXVIII

Site 9: Black spruce habitat   Date sampled: 23-VI-71

	Pool #
Species	15[a]
Culiseta morsitans	2
Total	2

[a] = Pool containing larvae which was not previously sampled (# larvae/dip not counted)

APPENDIX B - TABLE XXIX

Site 9: Black spruce habitat Date sampled: 4-VIII-71

	Pool #
Species	16[a]
Culex territans	5
Total	5

[a] = Pool containing larvae which was not previously sampled (# larvae/dip not counted)

APPENDIX B - TABLE XXX

Site 12: Black spruce habitat   Date sampled: 12-V-71

	Pool #												
Species	1	2	3	4	5	6	7	8	9	10	11	12	13
Aedes abserratus				1									
Aedes diantaeus								1					1
Aedes punctor	4	10	10	9	10	10	6	9	1	10	10	10	9
Total	4	10	10	10	10	10	6	10	1	10	10	10	10

APPENDIX B - TABLE XXXI

Site 12: Black spruce habitat Date sampled: 1-VI-71

	Pool #								
Species	3	4	5	6	8	9	10	12	13
Aedes communis					2				
Aedes diantaeus								10	1
Aedes punctor	11	14	10	8	8	12	29	5	14
Total	11	14	10	8	10	12	29	5	14

APPENDIX B - TABLE XXXII

Site 12: Black spruce habitat   Date sampled: 23-VI-71

Species	14[a]	15[a]
Aedes punctor	2	1
Culiseta morsitans	1	
Total	3	1

[a] = Pools containing larvae not previously sampled (# larvae/dip not counted)

APPENDIX B - TABLE XXXIII

Site 14: Black spruce habitat Date sampled: 13-V-71

	Pool #											
Species	1	2	3	4	5	6	7	8	9	10	11	12
Aedes communis		3		7	8	2			6	10		
Aedes diantaeus			6	1		4	3	3				2
Aedes implicatus		1										
Aedes punctor	10	6	4	2	2	4	7	7	4		10	8
Total	10	10	10	10	10	10	10	10	10	10	10	10

APPENDIX B - TABLE XXXIV

Site 14: Black spruce habitat   Date sampled: 2-VI-71

	Pool #							
Species	1	2	4	5	6	7	11	12
Aedes communis		10	1	10	9	10	9	6
Aedes diantaeus	18		3					
Aedes punctor			6		1		1	4
Total	18	10	10	10	10	10	10	10

APPENDIX B - TABLE XXXV

Site 1: Mixed wood habitat   Date sampled: 29-IV-71

Species	Pool #														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aedes canadensis							1								
Aedes communis				4			2				5	5			
Aedes diantaeus				1											
Aedes excrucians		2													
Aedes implicatus	6	2		2			6			9	4	5	10	9	10
Aedes intrudens	2							1			1				
Aedes punctor	2	3		2			1	7	3	1					
Aedes riparius		2													
Aedes stimulans														1	
Aedes trichurus		1		1				2	7						
Total	10	10	*	10	*	*	10	10	10	10	10	10	10	10	10

* No larvae present

APPENDIX B - TABLE XXXVI

Site 1: Mixed wood habitat   Date sampled: 31-V-71

	Pool #						
Species	2	3	4	7	8	9	10
Aedes canadensis		2			4		
Aedes cinereus	1	10			6	-	
Aedes excrucians	5	1					
Aedes fitchii	5						
Total	11	13	**	**	10	**	*

* No larvae present

** No larvae identified

APPENDIX B - TABLE XXXVII

Site 4: Mixed wood habitat   Date sampled: 4-V-71

	Pool #									
Species	1	2	3	4	5	6	7	8	9	10
Aedes canadensis								3		
Aedes cinereus								1		
Aedes communis		2		6	2	1	6		10	
Aedes diantaeus					1					
Aedes implicatus	10	1			5	7		3		6
Aedes intrudens		7	2	1	1	2	3			1
Aedes punctor								3		3
Aedes spencerii			3	1						
Aedes trichurus			5	2	1		1			
Total	10	10	10	10	10	10	10	10	10	10

APPENDIX B - TABLE XXXVIII

Site 11: Mixed wood habitat   Date sampled: 11-V-71

	Pool #									
Species	1	2	3	4	5	6	7	8	9	10
Aedes barri						1				
Aedes canadensis					1					
Aedes cinereus								4		
Aedes communis	1	8	7		2	3	10		1	1
Aedes diantaeus	1				6	1			1	
Aedes excrucians								1		
Aedes implicatus		1	2							
Aedes punctor	1	1	1	10	1	6		5	7	9
Aedes riparius	7									
Total	10	10	10	10	10	10	10	10	10	10

APPENDIX B - TABLE XXXIX

Site 11: Mixed wood habitat   Date sampled: 31-V-71

	Pool #			
Species	1	2	5	10
Aedes barri	1	1		1
Aedes canadensis			1	
Aedes communis			1	
Aedes diantaeus	10		7	10
Aedes excrucians	11	2		1
Total	22	3	9	12

APPENDIX B - TABLE XL

Site 13: Mixed wood habitat   Date sampled: 13_V-71

	Pool #	
Species	1	2
Aedes abserratus	2	
Aedes barri	7	
Aedes communis	1	
Aedes excrucians	15	1
Aedes intrudens	3	1
Aedes punctor	4	1
Aedes trichurus	68	7
Total	100	10

APPENDIX B - TABLE XLI

Site 13: Mixed wood habitat Date sampled: 2-VI-71

	Pool #			
Species	1	2	3	4
Aedes excrucians		2		
Aedes fitchii		1		
Total	**	3	**	*

* No larvae present

** No larvae identified

APPENDIX B - TABLE XLII

Site 17: Mixed wood habitat Date sampled: 19-V-71

Species	Pool # 1	2	3	4
Aedes barri	2	12	11	7
Aedes cinereus	1		2	4
Aedes excrucians	16	10	11	13
Aedes fithcii	5	3	1	1
Aedes riparius	1			
Total	25	25	25	25

APPENDIX B - TABLE XLIII

Site 17: Mixed wood habitat   Date sampled: 9-VI-71

Species	1	2	4	5[a]
Aedes vexans				13
Total	*	*	*	13

[a] = Pool containing larvae which was not previously sampled (# larvae/dip not counted)

* = No larvae present

APPENDIX C

FREQUENCY TABLES FOR LARVAL SAMPLING DATA

The following gives the frequency of values for the number of larvae per dip (dipper counts) for all sites sampled on each of their respective sampling dates from April 29 to August 4, 1971. Dipper count values, listed serially from lowest to highest, are given first, followed by their frequencies given in parenthesis. Tables I - XXI present frequency tables for sites 1 to 21 respectively, with sampling data for each site given in order from first to last date of sampling.

APPENDIX C - TABLE I

Site 1: Mixed wood habitat

Date Sampled	Frequency of Dipper Counts
29-IV-71	0(13), 1(14), 2(8), 3(11), 4(17), 5(6), 6(10), 7(4), 8(7), 9(6), 10(6), 11(3), 12(3), 13(4), 14(2), 16(1), 17(2), 19(1), 20(1), 25(1), 26(1), 27(1), 28(1), 33(1), 37(1), 55(1), 70(2), 75(1), 100(1), 130(1), 200(2), 235(1), 250(2), 300(1), 350(1), 457(1), 597(1)
31-V-71	0(30), 1(2), 2(1), 3(3), 9(1)

APPENDIX C - TABLE II

Site 2: Disturbed habitat

Date Sampled	Frequency of Dipper Counts
3-V-71	0(55), 1(39), 2(26), 3(9), 4(3), 5(4), 6(2), 8(1), 10(1)

APPENDIX C - TABLE III

Site 3: Disturbed habitat

Date Sampled	Frequency of Dipper Counts
3-V-71	0(13), 1(14), 2(7), 3(7), 4(3), 5(6), 6(2), 7(2), 8(2), 9(2), 10(4), 11(3), 14(2), 15(1), 16(2), 18(2), 19(1), 20(1), 24(1), 25(1), 26(1), 27(1), 28(1), 30(1), 31(1), 38(2), 39(1), 45(1), 47(1), 48(1), 53(1), 54(1), 58(2), 60(1), 64(1), 85(1), 88(1), 120(1), 125(1), 127(1), 182(1), 200(1), 224(1), 240(2), 270(1), 340(1), 700(1)
31-V-71	0(17), 1(4), 130(1), 180(1)
23-VI-71	0(4)
4-VIII-71	3(1), 10(1), 11(1), 15(1), 16(2), 31(1), 41(1), 51(1), 63(1)

APPENDIX C - TABLE IV

Site 4: Mixed wood habitat

Date Sampled	Frequency of Dipper Values
4-V-71	0(8), 1(6), 2(10), 3(13), 4(14), 5(9), 6(4), 7(3), 8(4), 9(6), 10(5), 11(4),

Continued

APPENDIX C - TABLE IV (continued)

Site 4: Mixed wood habitat

Date Sampled	Frequency of Dipper Counts
4-V-71	12(2), 13(1), 14(5), 15(2), 16(2), 17(1), 18(7), 21(1), 24(1), 29(2), 31(1), 36(2), 39(1), 68(1), 69(1), 80(1)
31-V-71	0(1)

APPENDIX C - TABLE V

Site 5: Poplar habitat

Date Sampled	Frequency of Dipper Counts
5-V-71	0(2), 1(3), 2(11), 3(4), 4(5), 5(3), 6(4), 7(12), 8(5), 9(4), 10(4), 11(3), 12(1), 13(2), 14(1), 17(2), 18(1), 20(1), 21(1), 23(1), 40(1)

APPENDIX C - TABLE VI

Site 6: Early regeneration habitat

Date Sampled	Frequency of Dipper Counts
5-V-71	0(50), 1(37), 2(26), 3(7), 4(9), 5(9), 7(3), 8(3), 10(2), 11(1), 12(1), 13(1), 15(1), 16(1), 21(1), 37(1), 94(1)

APPENDIX C - TABLE VII

Site 7: Disturbed habitat

Date Sampled	Frequency of Dipper Counts
6-V-71	0(24), 1(30), 2(16), 3(8), 4(5), 5(5), 6(3), 7(1), 8(2), 10(3), 11(1), 12(1), 16(1), 20(1), 24(2), 25(1), 26(1), 45(1), 50(1), 90(1)
31-V-71	0(10), 1(6), 3(2), 4(4), 5(1), 7(1), 8(1)

APPENDIX C - TABLE VIII

Site 8: Poplar habitat

Date Sampled	Frequency of Dipper Counts
10-V-71	0(2), 1(12), 2(6), 3(6), 4(3), 5(4), 6(2), 7(2), 8(3), 9(3), 10(2), 11(1), 13(1), 16(2), 17(1), 18(2), 19(1), 20(2), 21(1), 23(1), 27(1), 28(1), 29(1), 30(1), 31(1), 33(1), 34(1), 35(1), 37(1), 43(1), 49(1), 54(1), 55(1), 56(1), 61(1), 80(1), 82(1), 91(1), 113(1), 115(2), 125(1), 130(1), 135(1), 148(1), 175(1)
31-V-71	0(19), 1(3), 2(3)

APPENDIX C - TABLE IX

Site 9: Black spruce habitat

Date Sampled	Frequency of Dipper Counts
10-V-71	0(45), 1(19), 2(7), 3(9), 4(2), 5(4), 6(3), 7(1), 8(2), 9(1), 11(1), 12(1), 13(1), 16(1), 17(1), 21(1), 125(1)
1-VI-71	5(1), 7(1)

APPENDIX C - TABLE X

Site 10: Early regeneration habitat

Date Sampled	Frequency of Dipper Counts
11-V-71	0(32), 1(35), 2(14), 3(17), 4(12), 5(5), 6(2), 7(3), 8(2), 9(1), 10(1), 11(1), 12(1), 15(1), 21(1)
1-VI-71	0(42), 1(13), 2(7), 3(3), 5(1)
23-VI-71	0(4), 1(1)

APPENDIX C - TABLE XI

Site 11: Mixed wood habitat

Date Sampled	Frequency of Dipper Counts
11-V-71	0(7), 1(7), 2(10), 3(8), 4(11), 5(7), 6(2), 7(10), 8(4), 9(4), 10(7), 11(2), 12(1), 13(4), 14(3), 15(1), 16(1), 17(8), 18(2), 19(1), 20(3), 21(1), 23(3), 28(1), 29(1), 32(1), 39(1), 44(1), 46(1), 57(1), 60(1)
31-V-71	0(9), 1(6), 2(2), 3(3), 4(1), 5(2), 6(1), 7(1), 10(1), 13(2), 15(1), 18(1), 32(1)

APPENDIX C - TABLE XII

Site 12; Black spruce habitat

Date Sampled	Frequency of Dipper Counts
12-V-71	0(28), 1(16), 2(6), 3(12), 4(5), 5(5), 6(1), 7(4), 8(3), 9(1), 11(1), 13(2), 15(1), 16(2), 17(1), 20(1), 26(1)
1-VI-71	1(1), 2(3), 3(3), 4(1), 5(1), 6(3), 7(2), 10(1), 11(1), 15(1), 16(1)

APPENDIX C - TABLE XIII

Site 13: Mixed wood habitat

Date Sampled	Frequency of Dipper Counts
13-V-71	2(4), 3(3), 4(4), 5(9), 6(5), 7(5), 8(4), 9(4), 10(10), 11(11), 12(15), 13(4), 14(3), 15(4), 16(7), 17(2), 18(6), 19(2), 20(2), 21(1), 22(4), 23(1), 25(2), 30(1), 32(2), 35(1), 37(1), 38(1), 40(1), 60(1)
2-VI-71	0(60), 1(4), 2(5), 5(1)

APPENDIX C - TABLE XIV

Site 14: Black spruce habitat

Date Sampled	Frequency of Dipper Counts
13-V-71	0(1), 1(2), 3(1), 5(1), 7(1), 8(1), 10(1), 14(1), 15(1), 16(1), 17(1), 19(2), 20(4), 21(1), 22(1), 25(1), 28(1), 32(2), 35(1), 52(1), 64(1), 72(1), 83(1), 92(1), 145(1), 170(1)
2-VI-71	7(1), 18(1), 25(1), 29(1), 38(1), 40(1), 110(1), 200(1), 500(1)

APPENDIX C - TABLE XV

Site 15: Disturbed habitat

Date Sampled	Frequency of Dipper Counts
19-V-71	0(33), 1(28), 2(21), 3(10), 4(5), 5(2), 6(1)
9-VI-71	0(65), 1(8), 2(3), 4(1), 5(2), 7(1)

APPENDIX C - TABLE XVI

Site 16: Disturbed habitat

Date Sampled	Frequency of Dipper Counts
19-V-71	0(53), 1(22), 2(13), 3(9), 4(1), 7(1), 8(1)
9-VI-71	0(90)

APPENDIX C - TABLE XVII

Site 17: Mixed wood habitat

Date Sampled	Frequency of Dipper Counts
19-V-71	0(24), 1(19), 2(19), 3(12), 4(11), 5(4), 6(4), 7(1), 8(1), 11(1), 12(3), 16(1)
9-VI-71	0(54)

APPENDIX C - TABLE XVIII

Site 18: Ash habitat

Date Sampled	Frequency of Dipper Counts
20-V-71	0(30), 1(30), 2(10), 3(16), 4(7), 5(2), 6(7), 8(1), 9(1), 11(2), 32(1)
9-VI-71	0(92)

APPENDIX C - TABLE XIX

Site 19: Disturbed habitat

Date Sampled	Frequency of Dipper Counts
20-V-71	0(14), 1(18), 2(15), 3(27), 4(7), 5(5), 6(8), 7(4), 8(1), 10(1)
9-VI-71	0(100)
23-VI-71	0(99), 1(1)
4-VIII-71	0(20), 1(2), 2(3)

APPENDIX C - TABLE XX

Site 20: Disturbed habitat

Date Sampled	Frequency of Dipper Counts
25-V-71	0(25), 1(29), 2(12), 3(12), 4(4), 5(8), 6(3), 7(3), 8(1), 10(2), 13(1)
9-VI-71	0(94), 1(4), 2(2)
23-VI-71	0(78), 1(10), 2(6), 3(3), 5(1), 6(1), 8(1)

APPENDIX C - TABLE XXI

Site 21: Poplar habitat

Date Sampled	Frequency of Dipper Counts
25-V-71	0(77), 1(19), 2(3), 3(1)
9-VI-71	0(93), 2(1), 3(1), 5(1), 6(1), 12(1), 22(1), 35(1)

APPENDIX D

STATISTICAL SUMMARY OF DIPPER COUNT VALUES FOR ALL SITES ON ALL DATES SAMPLED

The following gives the sample size (# dips taken) and the range, mode, mean and variance of the dipper counts (# larvae/dip) for every date on which each of twenty-one sites was sampled.

Each table contains all sites sampled of one particular habitat type and presents the statistical summary for one of the four visits made to those sites. The mean and variance of dipper counts from all sites of one habitat type are given for each sampling visit.

Statistical summaries for disturbed habitat sites are given in tables I - IV; early regeneration habitat sites, tables V - VII; poplar-ash habitat sites, tables VIII - IX; black spruce habitat sites, tables X - XI and mixed wood habitat sites, tables XII - XIII.

APPENDIX D - TABLE I

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Disturbed habitat Sampled between May 3 and May 25, 1971

	Site #						
Statistics	2	3	7	15	16	19	20
Date sampled	3-V	3-V	6-V	19-V	19-V	20-V	25-V
Sample size	140	108	108	100	100	100	100
Range	0-10	0-700	0-90	0-6	0-8	0-10	0-13
Mode	0	1	1	0	0	3	1
Mean	1.3	39.0	5.1	1.4	0.9	2.8	2.3
Variance	2.7	8053.6	132.8	1.8	2.0	4.5	6.4

Mean and variance of # larvae/dip for all sites sampled: $\bar{x} = 7.54$; $s^2 = 1325.41$

APPENDIX D - TABLE II

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Disturbed habitat Sampled between May 31 and June 9, 1971

	Site #						
Statistics	2	3	7	15	16	19	20
Date sampled	31-V	31-V	31-V	9-VI	9-VI	9-VI	9-VI
Sample size	*	23	25	80	90	100	100
Range		0-180	0-8	0-7	-	-	0-2
Mode		0	0	0	0	0	0
Mean		13.7	1.9	0.4	0	0	0.08
Variance		2046.2	5.6	1.5	0	0	0.11

* All pools dry; Mean and variance of # larvae/dip for all sites sampled: $\bar{x} = 0.97$; $S^2 = 118.20$

APPENDIX D - TABLE III

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Disturbed habitat Sampled on June 23, 1971

Statistics	Site # 2	3	7	15	16	19	20
Date sampled	23-VI	23-VI	23-VI	23-VI	23-VI	23-VI	23-VI
Sample size	*	4	*	*	*	100	100
Range		-				0-1	0-8
Mode		0				0	0
Mean		0				0.01	0.5
Variance		0				0.01	1.6

* All pools dry; Mean and variance of # larvae/dip for all sites sampled: $\bar{x} = .25$; $S^2 = .86$

APPENDIX D - TABLE IV

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Disturbed habitat Sampled on August 4, 1971

	Site #						
Statistics	2	3	7	15	16	19	20
Date sampled	4-VIII	4-VIII	4-VIII	4-VIII	4-VIII	4-VIII	4-VIII
Sample size	*	10	*	*	*	25	*
Range		3-63				0-2	
Mode		16				0	
Mean		25.7				0.3	
Variance		397.1				0.5	

* All pools dry; Mean and variance of # larvae/dip for all sites sampled: $\bar{x} = 7.57$; $S^2 = 240.78$

APPENDIX D - TABLE V

Date sampled, Sampled size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Early Regeneration Habitat Sampled between May 5 and May 11, 1971

	Site #	
Statistics	6	10
Date sampled	5-V	11-V
Sample size	154	128
Range	0-94	0-21
Mode	0	1
Mean	3.1	2.5
Variance	73.3	9.8

Mean and variance of # larvae/dip for both sites sampled: $\bar{x} = 2.80$; $s^2 = 44.43$

APPENDIX D - TABLE VI

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Early Regeneration Habitat Sampled on May 31 and June 1, 1971

	Site #	
Statistics	6	10
Date sampled	31-V	1-VI
Sample size	*	66
Range		0-5
Mode		0
Mean		0.6
Variance		1.0

* All pools dry

APPENDIX D - TABLE VII

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling Data (# larvae/dip) from each Early Regeneration Habitat Sampled on June 23, 1971

	Site #	
Statistics	6	10
Date sampled	23-VI	23-VI
Sample size	*	5
Range		0-1
Mode		0
Mean		0.2
Variance		0.2

* All pools dry

APPENDIX D - TABLE VIII

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from Poplar-ash Habitat Sampled between May 5 and May 25, 1971

	Site #			
Statistics	5	8	18	21
Date sampled	5-V	10-V	20-V	25-V
Sample size	71	85	107	100
Range	0-40	0-175	0-32	0-3
Mode	7	1	0,1	0
Mean	7.6	29.4	2.3	0.3
Variance	40.9	1821.1	13.8	0.3

Mean and variance of # larvae/dip for all sites sampled: $\bar{x} = 8.61$; $S^2 = 492.13$

APPENDIX D - TABLE IX

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Poplar-ash Habitat Sampled between May 31 and June 9, 1971

	Site #			
Statistics	5	8	18	21
Date sampled	31-V	31-V	9-VI	9-VI
Sample size	*	25	92	100
Range		0-2	-	0-35
Mode		0	0	0
Mean		1.1	0	0.9
Variance		0.1	0	18.7

* All pools dry; Mean and variance of # larvae/dip for all sites sampled: $\bar{x} = .43$; $S^2 = 8.80$

APPENDIX D - TABLE X

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Black Spruce Habitat Sampled between May 10 and May 13, 1971

	Site #		
Statistics	9	12	14
Date sampled	10-V	12-V	13-V
Sample size	100	90	32
Range	0-125	0-26	0-170
Mode	0	0	20
Mean	3.5	3.6	34.0
Variance	170.0	25.4	1594.0

Mean and variance of # larvae/dip for all sites sampled: $\bar{x} = 7.75$; $S^2 = 416.05$

APPENDIX D - TABLE XI

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Black Spruce Habitat Sampled on June 1 and June 2, 1971

	Site #		
Statistics	9	12	14
Date sampled	1-VI	1-VI	2-VI
Sample size	2	18	9
Range	5-7	1-16	7-500
Mode	5,7	2,3,6	*
Mean	6.0	6.1	107.4
Variance	2.0	19.3	25385.5

* All values occur once; Mean and variance of # larvae/dip for all sites sampled: $\overline{x}$ = 37.52; S^2 = 9543.82

APPENDIX D - TABLE XII

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Mixed Wood Habitat Sampled between April 29 and May 19, 1971

	Site #				
Statistics	1	4	11	13	17
Date sampled	29-IV	4-V	11-V	13-V	19-V
Sample size	140	117	115	120	100
Range	0-597	0-80	0-60	2-60	0-16
Mode	4	4	4	12	0
Mean	29.8	10.0	10.3	13.2	2.6
Variance	6981.3	168.5	121.5	77.8	8.8

Mean and variance of # larvae/dip for all sites sampled:

$\bar{x} = 14.13$; $S^2 = 1802.78$

APPENDIX D - TABLE XIII

Date sampled, Sample size, Range, Mode, Mean and Variance of Sampling data (# larvae/dip) from each Mixed Wood Habitat Sampled between May 31 and June 9, 1971

	Site #				
Statistics	1	4	11	13	17
Date sampled	31-V	31-V	31-V	2-VI	9-VI
Sample size	37	1	31	70	54
Range	0-9	-	0-32	0-5	-
Mode	0	0	0	0	0
Mean	0.6	0	4.7	0.3	0
Variance	2.8	0	50.2	0.6	0

Mean and variance of # larvae/dip for all sites sampled: $\bar{x}$ = .97; S^2 = 11.37

APPENDIX E

SPECIES OF MOSQUITO LARVAE AND THEIR PROPORTION OF ALL LARVAE IDENTIFIED FROM EACH SITE ON EVERY DATE SAMPLED

The following gives the species of mosquito larvae and their proportion of all larvae identified from each site on every date sampled. In addition, the number of species found at each site and the total number of larvae identified from each site (sample size) is given.

Each table presents this information for all sites of a particular habitat type on one of four sampling visits. Disturbed habitat sites are found in tables I - IV; early regeneration habitat sites, tables V - VII; poplar-ash habitat sites, tables VIII - IX; black spruce habitat sites, tables X - XI; mixed wood habitat sites, tables XII - XIII.

APPENDIX E - TABLE I

Species of Mosquito Larvae, and their Proportion of all Larvae Identified from each Disturbed Habitat sampled between May 3 and May 25, 1971

Species	Site #						
	2 3-V[a]	3 3-V	7 6-V	15 19-V	16 19-V	19 20-V	20 25-V
Aedes barri				.12	.04		.04
Aedes canadensis				.01	.01		
Aedes cinereus			.01	.04	.03	.05	.01
Aedes communis	.04		.05				
Aedes dorsalis	.01						
Aedes excrucians	.04	.01	.06	.17	.16	.74	.77
Aedes fitchii	.04	.03	.25	.65	.76	.04	.03
Aedes implicatus	.80	.89	.35				
Aedes intrudens		.01					

continued

APPENDIX E - TABLE I (continued)

Species of Mosquito Larvae, and their Proportion of all Larvae Identified from each Disturbed Habitat sampled between May 3 and May 25, 1971

Species	Site #						
	2 3-V[a]	3 3-V	7 6-V	15 19-V	16 19-V	19 20-V	20 25-V
Aedes punctor			.07				
Aedes riparius	.06	.05	.16	.01		.17	.15
Aedes spencerii	.04		.03				
Aedes sticticus			.01				
Aedes trichurus		.02	.01				
n =	100	100	100	100	100	100	100
# species/site	6	6	10	6	5	4	5

[a] = date sampled; n = sample size

APPENDIX E - TABLE II

Species of Mosquito Larvae, and their Proportion of all Larvae Identified from each Disturbed Habitat sampled May 31 and June 9, 1971

Species	Site # 2 31-V[a]	3 31-V	7 31-V	15 9-VI	16 9-VI	19 9-VI	20 9-VI
Aedes canadensis			1.00				
Aedes cinereus		.11		.05			
Aedes excrucians		.20					
Aedes vexans		.69		.81			
Culex territans				.14			
Culiseta minnesotae							1.00
n =	*	35	12	3	**	**	1
# species/site	0	3	1	3	0	0	1

[a] = date sampled; * = all pools dry; ** = pools sampled, no larvae present; n = sample size

APPENDIX E - TABLE III

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Disturbed Habitat sampled on June 23, 1971

	Site #						
	2	3	7	15	16	19	20
Species	23-VI[a]	23-VI	23-VI	23-VI	23-VI	23-VI	23-VI
Culex territans						1.00	.94
Culiseta minnesotae							.06
n =	*	**	*	*	**	1	36
# species/site	0	0	0	0	0	1	2

[a] = date visited; * = all pools dry; ** = pools sampled, no larvae present

APPENDIX E - TABLE IV

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Disturbed Habitat sampled on August 4, 1971

Species	Site #						
	2	3	7	15	16	19	20
	4-VIII[a]	4-VIII	4-VIII	4-VIII	4-VIII	4-VIII	4-VIII
Aedes vexans		1.00					
Anopheles earlei						.14	
Culex territans						.86	
n =	*	10	*	*	*	7	*
# species/site	0	1	0	0	0	2	0

[a] = date visited; * = all pools dry

APPENDIX E - TABLE V

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Early Regeneration Habitat Sampled between May 5 and May 11, 1971

	Site #	
Species	6 5-V[a]	10 11-V
Aedes barri		.01
Aedes canadensis	.02	
Aedes communis		.01
Aedes diantaeus		.07
Aedes excrucians		.15
Aedes fithcii	.39	
Aedes implicatus	.55	.06
Aedes intrudens		.03

continued

APPENDIX E - TABLE V (continued)

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Early Regeneration Habitat Sampled between May 5 and May 11, 1971

Species	Site # 6 5-V[a]	Site # 10 11-V
Aedes punctor		.17
Aedes riparius	.01	.36
Aedes spencerii	.03	
Aedes sticticus		.02
Aedes trichurus		.12
n =	100	100
# species/site	5	10

[a] = date visited; n = sample size

APPENDIX E - TABLE VI

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Early Regeneration Habitat sampled on May 31 and June 1, 1971

Species	6 31-V[a]	10 1-VI
Aedes exrucians		1.00
n =	*	24
# species/site	0	1

[a] = date visited; * = all pools dry

APPENDIX E - TABLE VII

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Early Regeneration Habitat sampled on June 23, 1971

	6	10
	23-VI[a]	23-VI
Culex territans		
n =	*	2
# species/site	0	1

[a] = date visited; * all pools dry

APPENDIX E - TABLE VIII

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Poplar-ash Habitat sampled between May 5 and May 25, 1971

Species	Site # 5 5-V[a]	8 10-V	18 20-V	21 25-V
Aedes barri		.03	.19	.17
Aedes canadensis		.07	.03	
Aedes cinereus		.03	.38	.17
Aedes communis	.01			
Aedes diantaeus			.03	
Aedes excrucians		.01	.32	.58
Aedes fitchii		.05	.01	.08
Aedes implicatus	.76	.81		

continued

APPENDIX E - TABLE VIII (continued)

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Poplar-ash Habitat sampled between May 5 and May 25, 1971

	5	8	18	21
	5-V[a]	10-V	20-V	25-V
Aedes intrudens	.21		.04	
Aedes trichurus	.03			
n =	100	100	100	100
# species/site	4	6	7	4

[a] = date visited; n = sample size

APPENDIX E - TABLE IX

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Poplar-ash Habitat sampled on May 31 and June 9, 1971

Species	5 31-V[a]	8 31-V	18	21
Aedes cinereus		.20		
Aedes vexans				1.00
Culex territans		.80		
n =	*	2	**	31
# species/site	0	2	0	1

[a] = date visited; n = sample size; * = all pools dry; ** = pools sampled, no larvae present

APPENDIX E - TABLE X

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Black Spruce Habitat Sampled between May 10 and May 13, 1971

	9	12	14
	10-V[a]	12-V	13-V
Aedes abserratus	.03	.01	
Aedes communis			.16
Aedes diantaeus	.12	.02	.30
Aedes implicatus			.01
Aedes punctor	.85	.97	.53
n =	100	100	100
# species/site	3	3	4

[a] = date visited; n = sample size

APPENDIX E - TABLE XI

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Black Spruce Habitat Sampled on June 1 and June 2, 1971

Species	Site #		
	9 1-VI[a]	12 1-VI	14 2-VI
Aedes communis	.10	.01	.62
Aedes diantaeus	.41	.09	.24
Aedes punctor	.49	.90	.14
n =	37	124	88
# species/site	3	3	3

[a] = date visited; n = sample size

APPENDIX E - TABLE XII

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Mixed Wood Habitat sampled between April 29 and May 19, 1971

Species	Site #				
	1	4	11	13	17
	29-IV[a]	4-V	11-V	13-V	19-V
Aedes abserratus				.02	
Aedes barri			.01	.06	.32
Aedes canadensis	.01	.03	.01		
Aedes communis	.13	.27	.33	.01	
Aedes cinereus		.01	.04		.07
Aedes diantaeus	.01	.02	.09		
Aedes excrucians	.02		.01	.15	.50
Aedes fitchii					.10
Aedes implicatus	.53	.32	.03		

continued

APPENDIX E - TABLE XII (continued)

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Mixed Wood Habitat sampled between April 29 and May 19, 1971

Species	Site #				
	1	4	11	13	17
	29-IV[a]	4-V	11-V	13-V	19-V
Aedes intrudens	.03	.17		.04	
Aedes punctor	.16	.06	.41	.05	
Aedes riparius			.07		.01
Aedes spencerii		.04			
Aedes stimulans	.01				
Aedes trichurus		.09		.68	
n =	100	100	100	100	100
# species/site	9	9	9	7	5

[a] = date visited; n = sample size

APPENDIX E - TABLE XIII

Species of Mosquito Larvae and their Proportion of all Larvae Identified from each Mixed Wood Habitat sampled between May 31 and June 9, 1971

Species	Site # 1 31-V	4 31-V	11 31-V	13 2-VI	17
Aedes barri			.65		
Aedes canadensis	.18		.02		
Aedes communis			.02		
Aedes cinereus	.50				
Aedes diantaeus			.59		
Aedes excrucians	.18		.30	.66	
Aedes fitchii	.15			.33	
n =	34	**	46	3	**
# species/site	4	0	5	2	0

[a] = date visited; n = sample size; ** = pools sampled, no larvae present

APPENDIX F

DAILY TEMPERATURES AND PRECIPITATION - W.N.R.E., PINAWA, MANITOBA, MAY, JUNE, JULY AND AUGUST - 1970 AND 1971

Tables I - VIII give daily maximum (Max. Temp.) and minimum (Min. Temp.) air temperatures in degrees fahrenheit ($^{\circ}$F.); precipitation (Ppt.) as the sum of rainfall and one-tenth of snowfall in inches and the monthly sum of precipitation for the months of May, June, July and August of 1970 and 1971.

All data was recorded at the Whiteshell Nuclear Research Establishment and was supplied through the courtesy of Mr. A. Reimer, Biometeorologist, W.N.R.E., Pinawa, Man.

APPENDIX F - TABLE I

Daily Temperatures and Precipitation

MAY, 1970

Day	Max. Temp. °F.	Min. Temp. °F.	Ppt. (inches)
1	40	23	0
2	64	24	0
3	58	34	0
4	38	28	0.30
5	48	25	0
6	68	35	T
7	71	40	0
8	60	41	0.05
9	49	38	0.09
10	48	37	0
11	49	35	0.29
12	44	32	T
13	51	31	0.03
14	48	42	0.38
15	46	37	0.35
16	64	32	0
17	84	42	0
18	64	54	0
19	58	28	0.08
20	58	42	0.11
21	69	41	0
22	73	38	0
23	76	43	T
24	72	49	1.64
25	36	31	T
26	47	30	0.10
27	54	35	0
28	64	42	1.09
29	63	49	0.06
30	68	45	0.04
31	67	50	T
			Total = 4.61

T = trace

APPENDIX F - TABLE II

Daily Temperatures and Precipitation

JUNE, 1970

Day	Max. Temp. °F.	Min. Temp. °F.	Ppt. (inches)
1	62	44	0
2	70	41	0
3	79	42	0
4	80	50	0
5	86	44	0
6	82	64	0
7	84	41	0
8	89	61	0.41
9	80	63	0
10	79	54	0
11	65	57	0.09
12	79	58	0
13	80	58	0
14	77	52	0
15	71	56	0.02
16	72	56	0.20
17	74	54	0.03
18	60	45	0
19	69	35	0
20	72	41	0
21	72	50	0
22	81	41	0.25
23	74	63	T
24	67	43	0.14
25	57	48	0.01
26	70	54	0
27	72	48	0.08
28	82	58	0.01
29	86	65	0
30	84	65	0.22
		Total	= 1.46

T = trace

APPENDIX F - TABLE III

Daily Temperature and Precipitation

JULY, 1970

Day	Max. Temp. °F.	Min. Temp. °F.	Ppt. (inches)
1	80	55	0
2	70	60	0.16
3	67	54	T
4	73	48	0
5	80	50	0.22
6	81	62	0
7	75	59	T
8	80	53	0
9	89	61	0
10	88	65	0
11	88	62	0.34
12	84	67	0.10
13	83	62	0.40
14	70	62	0.95
15	81	55	0
16	85	60	0
17	72	56	T
18	62	57	0.30
19	72	47	0
20	75	44	0
21	79	53	0
22	78	62	0.22
23	82	62	0
24	70	62	0.38
25	84	55	0
26	81	67	0
27	80	53	0
28	85	53	0.01
29	79	65	0.55
30	82	64	0
31	68	60	0
			Total = 3.63

T = trace

APPENDIX F - TABLE IV

Daily Temperatures and Precipitation
AUGUST, 1970

Day	Max. Temp. °F.	Min. Temp. °F.	Ppt. (inches)
1	83	53	0
2	64	52	0.01
3	68	49	0
4	78	51	0
5	84	50	0.03
6	87	56	0
7	88	65	0
8	86	63	0
9	78	63	0
10	82	45	0
11	88	53	0
12	89	58	0
13	92	56	0
14	79	64	0
15	65	53	0.18
16	64	49	0
17	84	49	0.08
18	75	64	0.02
19	68	50	0
20	68	48	0
21	62	43	0.56
22	69	55	0
23	76	41	0
24	77	41	0
25	70	47	0
26	78	43	0.14
27	69	57	0
28	70	40	0.08
29	70	50	1.29
30	64	46	0
31	69	36	0
		Total	= 2.39

APPENDIX F - TABLE V

Daily Temperatures and Precipitation

MAY, 1971

Day	Max. Temp. °F.	Min. Temp. °F.	Ppt. (inches)
1	49	30	0
2	59	30	0
3	61	29	0.03
4	62	29	0
5	63	30	0
6	68	30	0.05
7	49	37	0
8	66	27	0
9	77	41	0.04
10	55	45	T
11	50	30	0
12	72	31	0
13	65	39	0
14	78	43	0
15	65	46	0.15
16	73	30	0.32
17	55	49	0
18	54	34	0
19	62	29	0
20	62	33	0
21	68	30	0
22	55	46	0.40
23	54	44	0.70
24	49	44	T
25	63	37	0
26	67	34	0
27	73	37	0
28	78	46	0
29	57	49	0
30	63	32	0
31	67	35	0
		Total	= 1.69

T = trace

APPENDIX F - TABLE VI

Daily Temperatures and Precipitation

JUNE, 1971

Day	Max. Temp. °F.	Min. Temp. °F.	Ppt. (inches)
1	73	33	0
2	79	46	0
3	85	56	0
4	84	49	0.67
5	73	63	0.08
6	64	57	0.22
7	61	49	0
8	67	35	0
9	73	42	0.07
10	64	56	0.11
11	80	56	0
12	79	59	0
13	75	53	0
14	78	49	0
15	79	54	0.51
16	77	57	0
17	77	56	0.05
18	73	55	0.05
19	65	50	0.24
20	67	51	0
21	75	41	0
22	77	52	0.01
23	64	53	0
24	61	43	0
25	74	53	0.05
26	74	59	0.01
27	69	63	0.41
28	72	53	0
29	75	54	0.16
30	64	52	1.21
		Total	= 3.86

T = trace

APPENDIX F - TABLE VII

Daily Temperatures and Precipitation

JULY, 1971

Day	Max. Temp. °F.	Min. Temp. °F.	Ppt. (inches)
1	74	50	0
2	75	49	0
3	79	65	0.26
4	69	52	0
5	72	55	0
6	71	48	0.19
7	74	54	0
8	69	55	0
9	69	51	0.02
10	72	52	0
11	75	49	0.02
12	77	64	0.05
13	77	57	0
14	74	55	0
15	78	56	0.05
16	66	50	0
17	72	38	0
18	75	51	0.09
19	70	54	0.27
20	75	52	0.02
21	69	60	0
22	72	43	0
23	73	43	0.01
24	82	58	0.18
25	60	52	0.15
26	66	52	0.03
27	58	46	0.10
28	58	44	0.47
29	62	41	0
30	72	46	0.10
31	64	57	0.01
			Total = 2.02

APPENDIX G

SPECIES OF ADULT FEMALE MOSQUITOES AND THE NUMBERS OF EACH CAUGHT AT SIX LOCATIONS DURING THE SPRING AND SUMMER OF 1970

The following gives the species and the number of adult females of each trapped during the evening and morning hours from 7:00 P.M. to 8:00 A.M. using solid CO_2 baited traps located at six sites representative of five habitat types during the period from 16 June through to 12 August, 1970.

APPENDIX G - TABLE I

Site 24: Disturbed habitat

Species	Sampling Date		
	8-VII	28-VII	4-VIII
Aedes abserratus	3		
Aedes dorsalis		4	
Aedes fitchii		1	
Aedes punctor	5		
Aedes sticticus	1		
Aedes spencerii		3	
Aedes vexans	55	1	1
Anopheles walkeri	5	1	
Culex tarsalis	2		
Total trapped	71	10	1

APPENDIX G - TABLE II

Site 7: Disturbed habitat

Species	Sampling date			
	16-VI	29-VI	15-VII	29-VII
Aedes abserratus	21	5		
Aedes dorsalis	1			
Aedes fitchii		1		
Aedes flavescens		5		
Aedes implicatus	1			
Aedes punctor	5	14	4	
Aedes pionips		1		
Aedes riparius		1		
Aedes sticticus	3	8		
Aedes spencerii		4		
Aedes vexans	76	114	8	2
Anopheles walkeri		4	2	

(continued)

APPENDIX G - TABLE II (continued)

Site 7: Disturbed habitat

Species	16-VI	29-VI	15-VII	29-VII
Culiseta minnesotae			4	
Total trapped	107	157	18	2

APPENDIX G - TABLE III

Site 22: Early regeneration habitat

Species	Sampling Date			
	16-VI	29-VI	9-VII	29-VII
Aedes abserratus	1		1	
Aedes barri			1	
Aedes excrucians			3	
Aedes fitchii			1	
Aedes flavescens		1	2	
Aedes implicatus			1	
Aedes intrudens			3	
Aedes punctor	3	13	2	
Aedes sticticus		2	12	
Aedes spencerii		1		
Aedes vexans	12	25	44	4

(continued)

APPENDIX G - TABLE III (continued)

Site 22: Early regeneration habitat

Species	Sampling Date			
	16-VI	29-VI	9-VII	29-VII
non-identifiable			1	
Total trapped	15	42	71	4

APPENDIX G - TABLE IV

Site 8: Poplar-ash habitat

Species	Sampling Date					
	16-VI	29-VI	15-VII	26-VII	29-VII	3-VIII
Aedes abserratus	8	6				
Aedes barri		2				
Aedes excrucians		2				
Aedes fitchii	1	6				
Aedes flavescens	1	4		1		
Aedes implicatus	1					
Aedes intrudens		1				
Aedes punctor	1	9	1		1	
Aedes riparius		5				
Aedes sticticus		24	1			
Aedes trichurus		7				
Aedes vexans	6	582	4	9	14	1

(continued)

APPENDIX G - TABLE IV (continued)

Site 8: Poplar-ash habitat

Species	Sampling Date					
	16-VI	29-VI	15-VII	26-VII	29-VII	3-VIII
non-identifiable	1	3				
Total trapped	19	651	6	10	15	1

APPENDIX G - TABLE V

Site 23: Black spruce habitat

Species	Sampling Date		
	2-VI	23-VI	12-VIII
Aedes abserratus	2		
Aedes communis	1		
Aedes fitchii		1	1
Aedes intrudens		2	
Aedes punctor	36	2	
Aedes sticticus	6		
Aedes trichurus	1		
Aedes vexans	3	1	2
Total trapped	49	6	3

APPENDIX G - TABLE VI

Site 1: Mixed wood habitat

Species	Sampling Date			
	8-VII	23-VII	28-VII	4-VIII
Aedes abserratus	24			
Aedes canadensis	1			
Aedes fitchii	1		1	
Aedes intrudens	4			
Aedes punctor	5			
Aedes sticticus	24	2		
Aedes vexans	207	4	5	3
Anopheles walkeri	3	4	3	
Culiseta inornata			2	
Culex restuans	1			
Mansonia perturbans	33	14		
Total trapped	303	14	12	3

APPENDIX H

SPECIES OF ADULT FEMALE MOSQUITOES AND THE NUMBERS OF EACH CAUGHT AT SEVEN LOCATIONS DURING THE SPRING AND SUMMER OF 1971

The following gives the species and the number of adult females of each trapped during the evening and morning hours from 7:00 P.M. to 8:00 A.M. using solid CO_2 baited traps located at seven sites representing five habitat types during the period from 1 June through to 12 August, 1971.

APPENDIX H - TABLE I

Site 7: Disturbed habitat

Species	June 1	June 14	June 17	June 21	June 23	June 28	July 1	July 5	July 8	July 13	July 20	July 26	August 4	August 12
Aedes abserratus	1	4	1	4	2	2				1	1			
Aedes barri											1			
Aedes communis	12			2										
Aedes dorsalis										1				
Aedes fitchii											2			
Aedes flavescens	1	2	2			2				1				
Aedes implicatus	14													
Aedes intrudens	5													
Aedes punctor		3	5	12	7	2	3			3	8		1	
Aedes riparius				3							20			
Aedes spencerii			8	7	2	3		1		28	16			

Sampling Date

(continued)

APPENDIX H - TABLE I (continued)

Site 7: Disturbed habitat

Species	Sampling Date													
	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes trichurus	56	1		1	5		1			1			1	
Aedes vexans				5	1	5	4	5		26	41	1	4	3
Anopheles walkeri			1							1				
Culiseta minnesotae										1				
Total trapped	89	10	17	34	17	14	8	6	0	63	89	1	6	3

APPENDIX H - TABLE II

Site 25: Disturbed habitat

Species	June 1	June 14	June 17	June 21	June 23	June 28	July 1	July 5	July 8	July 13	July 20	July 26	August 4	August 12
Aedes barri										1				
Aedes dorsalis							1		1					
Aedes punctor				1	1		2							
Aedes spencerii				1						6				
Aedes vexans					1	6		4		5	1	2		
Total trapped				2	2	6	3	4	1	12	1	2	0	0

APPENDIX H - TABLE III

Site 26: Disturbed habitat

Species	Sampling Date													
	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes abserratus		2	3				1							
Aedes implicatus		2												
Aedes intrudens		1												
Aedes punctor							1		1	1				1
Aedes riparius											1			
Aedes spencerii										1				
Aedes trichurus		1												
Aedes vexans							4	4		1	3	2	8	3
Anopheles walkeri							1						1	
non-identifiable								1						
Total trapped	0	6	3	0	0	0	7	5	1	3	4	2	9	4

APPENDIX H - TABLE IV

Site 10: Early regeneration habitat

Species	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes abserratus	1	2	1						1	2	1			
Aedes canadensis			1											
Aedes fitchii									1					
Aedes flavescens	2	5								1				
Aedes implicatus	13	1	1											
Aedes punctor	5	4	2		1					2				
Aedes riparius					1					1				
Aedes spencerii				1							1			
Aedes trichurus	5	2												
Aedes vexans				1		2	1		1	26	47	2	2	1
Aedes cinereus		1												

(continued)

APPENDIX H - TABLE IV (continued)

Site 10: Early regeneration habitat

Species	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes intrudens	1		1											
Culiseta minnesotae										2				
Mansonia perturbans										1				
non-identifiable	2								1		1			
Total trapped	29	15	6	2	2	2	1	0	4	35	50	2	2	1

APPENDIX H - TABLE V

Site 8: Poplar habitat

Species	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes abserratus		5	17	9	13	3	1	2	5	4				
Aedes barri								1						
Aedes cinereus			1	4	1	2			1				1	
Aedes communis	3	2												
Aedes excrucians			1							1				1
Aedes fitchii		1	5	1		1		1		1				
Aedes flavescens									1					
Aedes implicatus	3		3							1				
Aedes intrudens	2			1				1						
Aedes punctor		3	29	8	18	5	2	8	6	11	5			
Aedes riparius			2	1				1			1			

(continued)

APPENDIX H - TABLE V (continued)

Site 8: Poplar habitat

Species	June 1	June 14	June 17	June 21	June 23	June 28	July 1	July 5	July 8	July 13	July 20	July 26	August 4	August 12
Aedes sticticus									1	2	2		1	
Aedes spencerii										1				
Aedes trichurus	1	1										1		
Aedes vexans				37	5	23	15	103	76	342	80	34	56	21
Mansonia perturbans										2	1			
non-identifiable								1						
Total trapped	9	12	58	61	37	34	18	118	90	365	89	35	58	22

APPENDIX H - TABLE VI

Site 9: Black spruce habitat

Species	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes abserratus	1	2	4	7	10		1	1						
Aedes canadensis		1			1					1				1
Aedes cinereus				1					1				1	
Aedes communis				1	1			1		1				
Aedes diantaeus		1												
Aedes fitchii			1	5	1		2	2				1		
Aedes flavescens	2			2	1									
Aedes implicatus	13		2	1	2									
Aedes intrudens	1													
Aedes punctor	5	10	11	96	110	4	10	39	4	3	4	1	1	2
Aedes riparius		1			1			2					2	

(continued)

APPENDIX H - TABLE VI (continued)

Site 9: Black spruce habitat

Species	Sampling Date													
	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes spencerii							1							
Aedes trichurus	5	1		1	9									
Aedes trivittatus								1						
Aedes vexans		1		76	10	6	2	58	2	8	23	4	6	22
non-identifiable				1										
Total trapped	27	17	18	191	146	10	16	104	7	13	27	6	10	25

APPENDIX H - TABLE VII

Site 11: Mixed wood habitat

Species	Sampling Date													
	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes abserratus	10	14	13	15	7	1	3	3		1				
Aedes barri						1								
Aedes communis	1						1							
Aedes cinereus		4	4	8	1	2	4	1	1	3	1	1		1
Aedes excrucians				1					1			1		1
Aedes fitchii		2	3	1			1	2		1				
Aedes flavescens								2						
Aedes implicatus	7	1												
Aedes intrudens			1											
Aedes punctor	17	24	43	27	22	10	16	33	5	6	5	5	3	1
Aedes riparius				14	3									

(continued)

APPENDIX H - TABLE VII (continued)

Site 11: Mixed wood habitat

Species	Sampling Date													
	June						July						August	
	1	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes spencerii					1									
Aedes trichurus	3	1		1	1	2								
Aedes vexans		1		44		5	6	17	9	14	69	7	25	8
Culiseta minnesotae			1											
non-identifiable					2						1		1	
Total trapped	38	47	65	111	37	21	31	58	16	25	76	14	29	11

APPENDIX I

SPECIES OF ADULT FEMALE MOSQUITOES AND NUMBERS OF EACH TAKEN IN BITING COLLECTIONS IN PINAWA, MANITOBA, DURING THE SPRING AND SUMMER OF 1971

The following gives the species and number of adult females of each taken in biting collections in the town of Pinawa on 15 different evenings during the period from 1 June through to 12 August, 1971. In addition, the time in minutes required to catch 25 mosquitoes is given for each sampling date.

APPENDIX I - TABLE I

Species	Sampling Date														
	June							July						August	
	1	8	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes communis	15	2	1		1	2		1							
Aedes abserratus	9	18	5	8	6	6		9	4	1					
Aedes intrudens	1	4	17	16		5	1	4	1	2					
Aedes punctor					10		4	1	3	1	1				
Aedes abserratus-punctor							4		1		4		3		
Aedes communis-intrudens							6								
Aedes vexans					2	2	2	1	4	9	6	15	11	23	21
Aedes trichurus			1		2	1	4								
Aedes excrucians			1	1											
Aedes fitchii					2	1									
Aedes riparius					1	2									

(continued)

APPENDIX I - TABLE I (continued)

Species	Sampling Date														
	June							July						August	
	1	8	14	17	21	23	28	1	5	8	13	20	26	4	12
Aedes flavescens					1										
Aedes dorsalis						1	1								2
Aedes sticticus									1	5	2		1	1	1
Aedes spencerii												1			
Aedes cinereus															1
Anopheles earlei		1													
Mansonia perturbans						5	3	9	11	4	12	6	10	1	
non-identifiable										3		3			
Total collected	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Collection time (mins)	10	10	10	10	10	10	10	15	10	30	40	15	30	30	30

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