Not for publication

ANNUAL REPORT OF FOREST RESEARCH TECHNICIANS

LARCH SAWFLY POPULATION DYNAMICS STUDY 1965

by
J. A. Drouin, D. G. H. Ray and R. M. Smith

FOREST RESEARCH LABORATORY
WINNIPEG, MANITOBA
INTERNAL REPORT MS-32

DEPARTMENT OF FORESTRY
MAY, 1966

ANNUAL REPORT OF FOREST RESEARCH TECHNICIANS

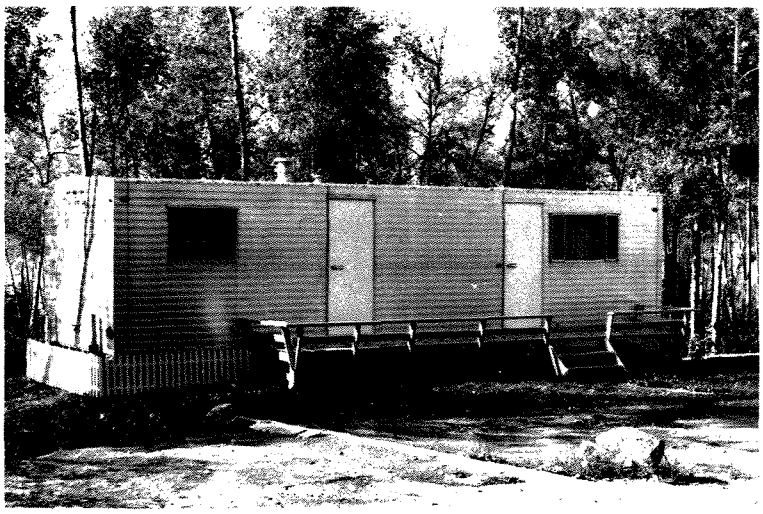
LARCH SAWFLY POPULATION DYNAMICS STUDIES

1965

by

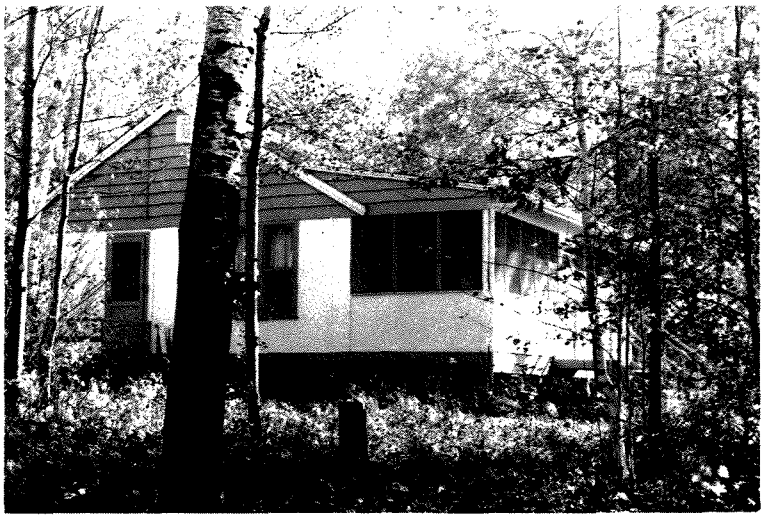
J.A. Drouin, D.G.H. Ray, R.M. Smith

MS-32



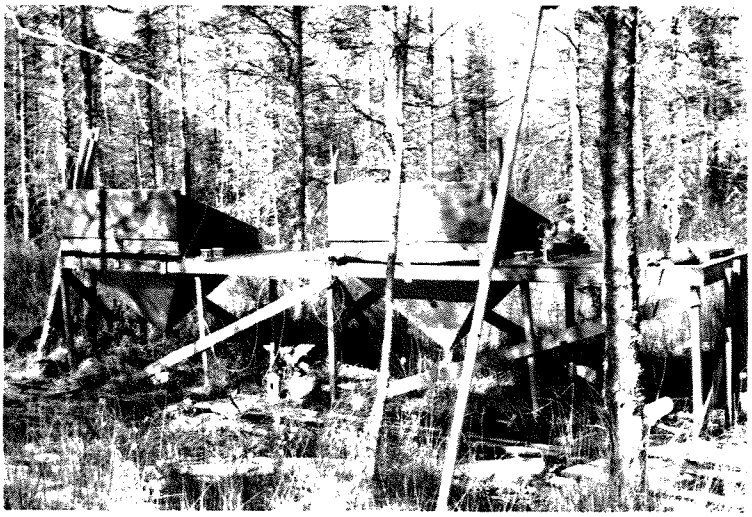
FOREST INSECT AND DISEASE TRAILER -- UNIT 1

Photo by J.A. Drouin



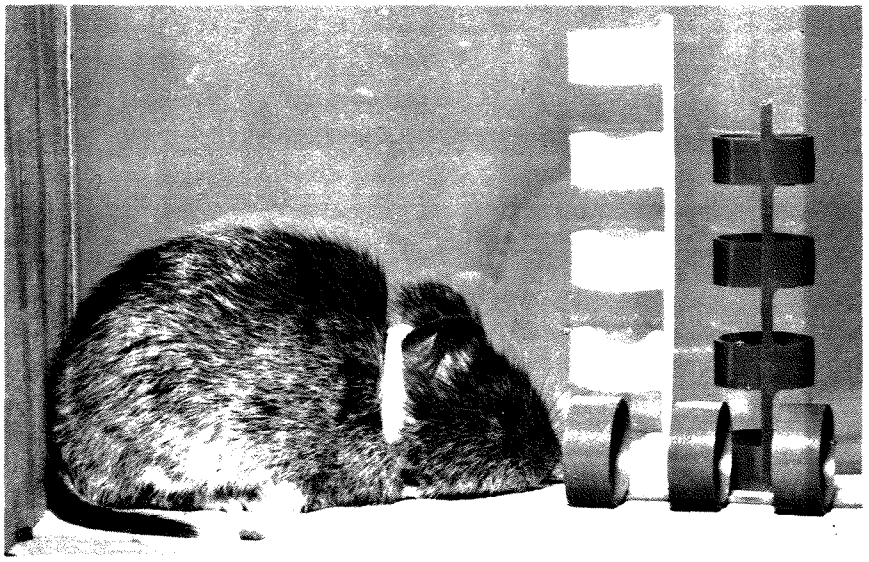
PORCH ADDITION TO CABIN 3

Photo by J.A. Drouin



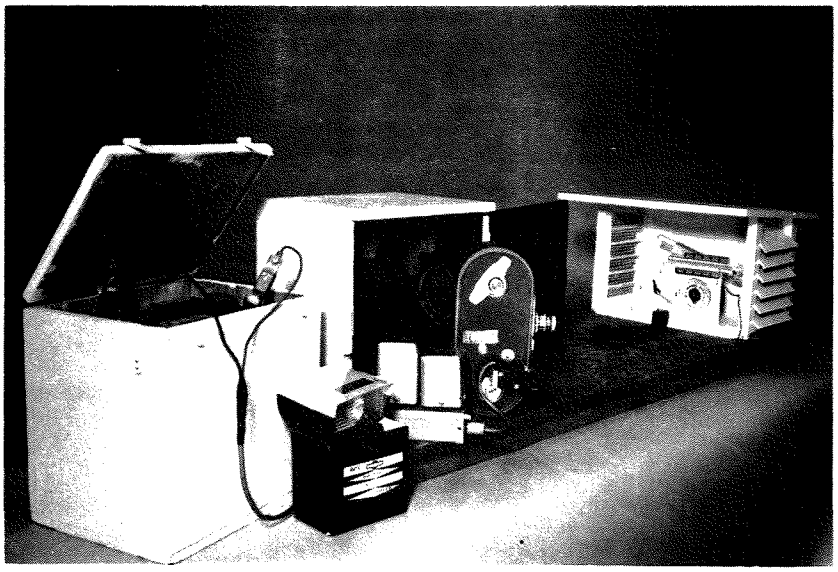
MODIFIED INVERTEBRATE PREDATOR SAMPLING FUNNELS

Photo by J.A. Drouin



COLOUR-CODED PLASTIC COLLAR ON A RED-BACKED VOLE

Photo by R.J. Cheale



PHOTOGRAPHIC SMALL-MAMMAL ACTIVITY RECORDING UNIT

Photo by R.J. Cheale

MASKED SHREW-PREDATOR OF LARCH SAWFLY COCOONS

Photo by D.G.H. Ray

ANNUAL REPORT OF FOREST RESEARCH TECHNICIANS

LARCH SAWFLY POPULATION DYNAMICS STUDIES

1965

by

J.A. Drouin, D.G.H. Ray, R.M. Smith

INTRODUCTION

This annual report deals with the operation and maintenance of the Whiteshell Field Station and the technical and field aspects of the research projects being conducted by the Larch Sawfly Investigations group from the Winnipeg laboratory.

During 1965, the collection of data was continued at six study plots for estimating the populations of the larch sawfly in all stages, parasites, vertebrate and invertebrate predators. Annual estimates were continued for mortality in the egg stage, in the larval instars and cocoon stages. Foliage sampling was carried out at three life table plots. This sampling technique gives a statistically acceptable estimate of foliage production. Topographical measurements of twenty-five six-foot grids were completed at three plots. Records of meteorological events, water table fluctuations, defoliation and host tree mortality and phenology were continued. Recording instruments to measure solar radiation, wind gusts and miles of wind, rainfall, relative humidity and temperature were maintained at each plot. The installation of generating and contact anemometers was completed in all six plots in 1965. Prior to phasing out, gust recorders developed and built at the Winnipeg laboratory, were calibrated with the commercial anemometers to obtain continuity in the data.

The continuing operation and development of a photographic unit for recording small mammal activity was limited in 1965 to the evaluation of a colour-coded plastic collar technique used to identify individuals from the film records.

These projects were reorganized in 1964 under the direction of the following research officers in their respective areas of program responsibilities:

W.J. Turnock - Project leader; planning and co-ordination of advanced synthesis; interpretation and reporting of results of overall project; bioclimatology; parasitism by *Bessa harveyi*.

W.G.H. Ives - Planning and co-ordination of the collection and primary analyses relating to life tables; assessment of egg and larval mortality.

J.A. Muldrew - Biological control studies; studies on introduced parasites; parasitism by Holocremnus nr. nematorum.

C.H. Buckner - Collaboration with Ives and Turnock in direction of planning and co-ordinating phases; vertebrate predators.

FIELD STATION OPERATION

The Whiteshell Field Station serves as field headquarters during the field season, May 4 to September 20th. The proposed station-improvement program was completed in 1965 excepting the addition of 12 yards of clay-capping at the south edge of the disposal field due to a lack of machinery available for the job. Completion of the remaining proposed improvements included: demolition of the small mammals hut, levelling of the grounds and seeding grass at this location, fencing around the 1,000 lb. propane storage tank, the grading, levelling, seeding of the grounds on the north side of the laboratory-insectary and around the new small mammals laboratory. Proposed work outline for 1966 includes completion of clay-capping at the disposal field, grading, levelling and seeding at and around the septic tanks.

Other than the assignment of the Forest Insect and Disease Survey trailer (#1) to K.L. Mortensen married quarters accommodation remained as follows:

Cottage 1 - W.G.H. Ives

Cottage 2 - C.H. Buckner

Cottage 3 - W.J. Turnock

Trailer 1 - K.L. Mortensen

Trailer 2 - J.A. Drouin

ASSIGNMENT OF PERSONNEL

In 1965, three Forest Research Technicians, four student assistants, (two with prior experience), one graduate assistant and two hourly rate employees were assigned to larch sawfly investigations. The loss of the graduate assistant and one student assistant in late August due to other commitments depleted the work force during a peak work load. The personnel and hourly rate categories follow:

FR-260-33-S	May 4 - Aug. 31	O. Werner	Graduate Assistant	20 weeks
FR-260-34-S	*May 4 - Sept. 30	J. Pocatello	Student Assistant	20 weeks
FR-260-35-S	May 4 - Aug. 31	R. Broeska	Student Assistant	20 weeks

* M.J. Pocatello -- Employment extended 6 weeks.

FR-260-43-S	May 4-	Sept. 15	E. Rotstein	Student Assistant	20 weeks
FR-260-45-S	June 24-	Aug. 31	J. Gray	Insect Sampling and Rearing Aide	10 weeks
FR-260-Casual	July 1-	Aug. 31	J. Mallory	Extra Labour	9 weeks
FR-260-Casual	July 1-	Aug. 31	D. Young	Extra Labour	9 weeks
FR-260-Casual	May 4-	Sept. 17	M. McNarland	Maintenance	20 weeks
FR-260-Casual	May 4-	Sept. 17	A. McNarland	Cook	20 weeks

Forest Research Technician E. Marchuk, on loan from the Winnipeg Laboratory, assisted during the peak work load period during spring and fall. A student assistant, D. More, from the Riding Mountain Field Station was also assigned temporary duties from July 19 to July 26.

TRANSPORTATION EQUIPMENT

No changes occurred in 1965 in the vehicle fleet operating from the field station.

POPULATION DYNAMICS STUDIES LIFE TABLE PLOTS

Fluctuations in larch sawfly populations were small in 1965 with a slight decrease at Pine Falls and minor increases at the other five plots. Drainage and a subsequent drop in water levels may account for the increase in populations at Seddon's Corner. Right-of-way clearing to this plot line in 1964, for highway improvements, created some interference with instrumentation and equipment due to increased accessibility. Removal of access walks and replanting of a willow and balsam poplar "screen" along the visible plot frontage curtailed these activities.

A sanitation-cut of tamarack attacked by Dendroctonus simplex near the Rennie plot was made by the Manitoba Forest Service during late winter. All infested trees tagged for removal were cut and destroyed by burning with further clearing of dead tamarack, brush and selective cutting along the road right-of-way. Bark beetle attacks were also recorded approximately four chains north of the plot in an area reserved for branch sampling. In August, three trees were dying and had the cambium completely infested up to 24 feet from the root crown. Average D.B.H. for the infested trees was 7.0 inches.

Meteorological instruments and oil drop funnels were serviced at weekly intervals while emergence traps were changed every second week. The network of 2 x 12 inch planking, to facilitate access and servicing, was extended at the two remaining plots. This complex of duckboards greatly increases access, speed in servicing and reduces disturbance of the plot floor to a minimum. The Pine Falls plot was retallied in 1965. This plot supports a dense, vigorous growth of tamarack and black spruce of fire origin, interspersed with a few mature tamarack and black spruce left by the fire. Growth conditions, mortality of mature and suppressed trees and loss of tags made re-tallying necessary. Plans for 1966 include the re-tallying of dead trees at the remaining five plots.

EFFECTS OF DEFOLIATION ON HOST STANDS

Tree mortality caused by defoliation combined with flooding or suppression may occur after three or four years of severe sawfly attack. Deterioration of the host stands is being evaluated in the six life table plots. Records are taken annually on the individual trees for defoliation, growth and mortality. The average defoliation, diameters and mortality for the current year are shown in Table I.

DEVELOPMENT OF TECHNIQUES

Subsequent to tests at the Rennie plot in 1964, a modified sampling technique for estimating populations of invertebrate predators on larch was used at all six plots in 1965. This refinement utilizes pyrethrin and CO_2 to remove insects from branches placed within the chamber formed by the hood and the collecting funnel. (See photo). In 1965 all plots were equipped with two sorting tables and funnels with hoods. The screens over the funnels were modified to slide backwards through the rear of the hoods, promoting access to the inside of the funnels for brushing insects into the retrieving vial at the base. Preliminary analysis of data on this technique indicates a higher recovery of insects, particularly the more active predators, (aphids spp. and tortricids), a decrease in damage to specimens, less debris in the vials and a reduction in sorting time.

Adult emergence traps are plastic containers fitted inside with a metal funnel held in place by a plastic retainer ring. These traps fit at the apex of each emergence cage (100 per plot) to trap emerging sawfly adults and other insects. Prior to 1965, the funnels inside these traps were painted annually with Dieldrin, a very toxic and residually effective insecticide. After some trials, commercial Vapona insecticide strips were cut into 3/4" x 1/2" rectangles and stapled to the inner funnel lip. The ease and speed of application, safe handling properties, and the residual effectiveness of this insecticide proved very satisfactory.

Foliage sampling was carried out at three plots during 1965. This technique provides a basis for comparing intensity of sawfly infestations in stands of larch differing in the volume of foliage available. This foliage assessment will be completed at the remaining three plots in 1966.

Topographical measurements were completed at three plots using a six-foot square jig which provides thirty-six measurements from an artificial datum to the moss level, using twenty-five grids in each plot. These measurements furnish a sample of the contours in relation to the established water levels. Other developments involving plots, techniques or instrumentation were as follows: the equipping of multiple contact and self-generating anemometers at all plots, field trials of a tape recording unit, weekly estimation of defoliation of each tree over the oil drop funnels at each plot. The coding and transfer of data on larval instars, rearings, parasitism, temperature, humidity, pyrheliometer, gust records and rainfall to data sheets for punching on I.B.M. cards was continued.

TABLE I

Tamarack Mortality and Defoliation in Six Population Dynamics Plots
1965

PLOT	No. living trees remaining in plot 1965	No. trees dying in 1965	% trees dying in 1965	Average DBH of dead trees	Living Trees**				Defoliation	
					DBH (Inches)		Height (Feet)		%	
					Mean	Range	Mean	Range	Mean	Range
RENNIE 1.	197	4	2.0	2.4	4.8	2.7-6.9	45.0	30-57	8.8	2-25
TELFORD 2.	176	2	1.1	1.3	1.3	0.5-4.5	9.7	4 -28	0.93	0-14
SEDDON'S CORNER* 3.	497	8	1.6	2.5	3.6	1.3-7.0	33.6	19-49	7.2	0-29
PINE FALLS† 4.	570	2	0.4	0.8	1.7	0.2-9.3	22.4	5-52	9.2	0-40
RIVERTON 5.	273	0	0	---	3.5	1.0-8.8	29.8	10-52	5.2	0-18
DARWIN 6.	111	-	---	---	6.5†	2.2-11.3*	42.0*	19 -56*	6.1	0-21

** Calculations based on a random sample of 40 trees
* Calculations based on a random sample of 30 trees
† Plot retallied in 1965

LARCH SAWFLY POPULATION AND SURVIVAL ESTIMATES

Data from larch sawfly egg, larval and cocoon collections were coded and recorded on data sheets for punching on I.B.M. cards. Populations per acre for adult and egg populations for 1965 and confidence intervals for each stage were calculated and are shown in Table II.

Oil funnel data were entered on data sheets then punched on I.B.M. cards. Using the Fortran system, a source program was written to obtain a compilation of proportion of larvae in each condition, by instar, weekly collections, and seasonal totals (Table III).

MORTALITY FACTORS

Water Tables:

The larch sawfly is susceptible to mortality from flooding in the larval and cocoon stages. The purpose of water level measurements is to provide data from which to determine the effects of fluctuating water levels on the sawfly survival. During the field season, water levels are taken weekly at all six plots. During the winter, readings are taken monthly unless the pipes freeze. The ground surface was inundated at the Darwin plot until mid-June with water levels subsiding slowly until the latter part of July after which levels remained constant until mid-September. Water levels were also higher at both the Rennie and Telford plots than in 1964. At the Rennie plot, beaver dams caused marked fluctuations every three weeks; the time necessary to rebuild, until removal. Water levels at the Pine Falls plot were lower in 1965 and at Seddon's Corner the drainage ditches along the highway caused a marked lowering. Water levels for each plot are shown in Table IV.

Meteorological Records:

Weather conditions in 1965 were cooler than normal with heavier snowfall while rainfall for the year was about average. Cool, cloudy, wet weather prevailed during most of May and June. Temperatures averaged below normal, ranging from lows of 26° to highs of 84° in May and June. This retarded foliage growth on some tree species and led to correspondingly late insect development.

Temperatures in July and September were the coldest in 47 and 91 years respectively, with recorded lows of 33° in July to below freezing in September (26°). Rainfall was near average during these periods. August temperatures ranged from a high of 92° to a low of 26° (August 28). Rainfall was below normal during this period. The meteorological data accumulated in 1965 has been summarized on data sheets for transfer to I.B.M. data cards.

TABLE II

Adult and egg populations per acre and their one-half 95% confidence intervals (d) in 1965

Plot	Adults		Eggs	
	No. per acre	|d|	No. per acre	|d|
Rennie	2,831	1,448	686,714	157,820
Telford	218	4,086	22,195	14,866
Seddon's Corner	2,831	1,448	421,990	177,985
Pine Falls	45,738	11,078	416,897	7,763
Riverton	218	4,265	347,044	16,444
Darwin	*	---	206,563	78,124

* No adults collected in 1965

TABLE III

Proportion of Larvae in Each Condition by Instar and Seasonal Totals for Oil Funnel Collections at Six Life Table Plots 1965

RENNIE 1

CONDITION	Instars I	II	III	IV	V(Early)	V(Mature)	V Holocremnus
Healthy	0.0000	1.0000	.7692	.5416	.7241	.9514	0.0000
Diseased	0.0000	0.0000	.0769	.0833	.1379	.0326	0.0000
Killed by Predator	0.0000	0.0000	.1538	.3750	.1206	.0087	0.0000
Decapitated or mutilated	0.0000	0.0000	0.0000	0.0000	.0172	.0072	0.0000
TOTALS	0	1	13	24	58	1379	0

TELFORD 2

CONDITION	Instars I	II	III	IV	V(Early)	V(Mature)	V Holocremnus
Healthy	0.0000	1.0000	0.0000	0.0000	1.0000	1.0000	0.0000
Diseased	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000
Killed by Predator	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Decapitated or mutilated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TOTALS	0	1	0	1	5	35	0

SEDDON'S CORNERS 3

CONDITION	Instars I	II	III	IV	V(Early)	V(Mature)	V Holocremnus
Healthy	0.0000	0.0000	.5000	.5500	.3333	.9371	0.0000
Diseased	0.0000	0.0000	.2500	.2000	.3809	.0267	0.0000
Killed by Predator	0.0000	0.0000	.2500	.2500	.1904	.0235	0.0000
Decapitated or mutilated	0.0000	0.0000	0.0000	0.0000	.0952	.0125	0.0000
TOTALS	0	0	4	20	21	636	0

TABLE III (Cont'd)

PINE FALLS 4

CONDITION	Instars I	II	III	IV	V(Early)	V(Mature)	V Holocremnus
Healthy	0.0000	0.0000	.5000	.6198	.9100	.9156	1.0000
Diseased	0.0000	0.0000	.0833	.0743	.0311	.0144	0.0000
Killed by Predator	0.0000	0.0000	.4166	.2479	.0519	.0072	0.0000
Decapitated or mutilated	0.0000	0.0000	0.0000	.0578	.0069	.0626	0.0000
TOTALS	0	0	12	121	289	415	338

RIVERTON 5

CONDITION	Instars I	II	III	IV	V(Early)	V(Mature)	V Holocremnus
Healthy	0.0000	1.0000	.6250	.6165	.8490	.9402	1.0000
Diseased	0.0000	0.0000	.2500	.2481	.0754	.0149	0.0000
Killed by Predator	0.0000	0.0000	.1250	.1278	.0566	.0447	0.0000
Decapitated or mutilated	0.0000	0.0000	0.0000	.0075	.0188	0.0000	0.0000
TOTALS	0	1	8	133	106	67	154

DARWIN 6

CONDITION	Instars I	II	III	IV	V(Early)	V(Mature)	V Holocremnus
Healthy	0.0000	1.0000	1.0000	.8043	.7307	.9647	0.0000
Diseased	0.0000	0.0000	0.0000	.0869	.1153	.0153	0.0000
Killed by Predator	0.0000	0.0000	0.0000	.1086	.1153	.0184	0.0000
Decapitated or mutilated	0.0000	0.0000	0.0000	0.0000	.0384	.0015	0.0000
TOTALS	0	5	7	46	52	652	0

TABLE IV

Water Levels in Six Larch Sawfly Population Dynamics Plots
1965

RENNIE 1		TELFORD 2		SEDDON'S CORNER 3		PINE FALLS 4		RIVERTON 5		DARWIN 6	
Date	Level	Date	Level	Date	Level	Date	Level	Date	Level	Date	Level
						May 12	25.2				
May 17	25.1	May 19	25.6	May 21	22.1	--	--	May 26	28.2	May 27	16.5
--	--	Jun 2	26.6	Jun 1	21.7	Jun 3	25.2	Jun 1	24.4	Jun 2	17.9
Jun 8	22.2	Jun 9	26.6	Jun 8	21.5	Jun 10	27.1	Jun 7	23.6	Jun 9	15.5
Jun 15	24.1	Jun 16	27.5	Jun 15	21.7	Jun 17	30.0	Jun 14	25.5	Jun 16	17.7
Jun 22	25.2	Jun 23	27.7	Jun 22	22.6	Jun 24	32.0	Jun 21	26.7	Jun 23	19.6
Jun 29	23.9	Jun 30	26.9	Jun 29	20.9	Jul 1	30.7	Jun 28	25.9	Jun 30	17.7
Jul 6	23.9	Jul 7	26.5	Jul 6	20.0	Jul 8	31.0	Jul 5	25.4	Jul 7	18.5
Jul 13	25.5	Jul 14	26.9	Jul 13	21.5	Jul 15	33.9	Jul 12	26.5	Jul 14	20.2
Jul 20	26.2	Jul 21	26.4	Jul 20	21.6	Jul 22	28.5	Jul 19	23.2	Jul 21	18.2
Jul 27	29.1	Jul 28	27.9	Jul 27	22.6	Jul 29	29.4	Jul 26	25.2	Jul 28	20.7
Aug 3	32.2	Aug 4	28.2	Aug 3	23.9	Aug 5	33.0	Aug 2	24.9	Aug 4	21.5
Aug 10	35.1	Aug 11	28.3	Aug 10	23.6	Aug 12	37.2	Aug 9	27.2	Aug 11	22.0
Aug 17	36.6	Aug 18	28.3	Aug 17	25.7	Aug 19	40.0	Aug 16	27.5	Aug 18	24.2
Aug 24	40.6	Aug 25	29.2	Aug 24	28.9	Aug 26	42.2	Aug 23	28.1	Aug 25	24.7
Aug 31	39.6	Sep 1	28.8	Aug 31	29.1	Sep 2	42.9	Aug 30	28.1	Sep 1	25.2
Sep 7	32.4	Sep 8	26.8	Sep 7	23.1	Sep 9	33.4	Sep 6	17.0	Sep 8	22.2
Oct 13	27.2	Oct 13	25.8	Oct 13	22.2	Oct 8	30.5	Oct 12	29.6	Oct 13	18.0
Oct 26	25.6	Oct 26	25.9	--	--	Oct 25	29.7	Oct 25	28.5	Oct 26	17.9
Nov 17	26.3	Nov 17	Frozen	Nov 17	22.5	Nov 18	32.5	Nov 18	28.6	Nov 17	Frozen

VERTEBRATE PREDATORS

Small Mammal Populations

Small mammal populations at the larch sawfly life table sites were censused twice in 1965. Data from the spring census (in May) is used in estimating overwinter mortality and spring breeding stock potential. The fall census (September-October) provides data on peak population levels which will be used to determine the effect of the small mammal predators on the larch sawfly populations.

The following is a list of the mice, voles and shrews usually encountered on the six plots in Manitoba:

Sorex cinereus cinereus Kerr
(the common cinerous shrew)
Sorex arcticus laricorum Jackson
(the southern saddle-backed shrew)
Microsorex hoyi hoyi (Baird)
(the American pygmy shrew)
Blarina brevicauda manitobensis Anderson
(the Manitoba short-tailed shrew)
Peromyscus maniculatus bairdii (Hoy and Kennicott)
(Baird's white-footed mouse)
Synaptomys cooperi cooperi Baird
(Cooper's lemming vole)
Clethrionomys gapperi lorengi (Bailey)
(the plains red-backed vole)
Microtus pennsylvanicus drummondii (Audubon and Bachman)
(Drummond's meadow vole)
Zapus hudsonius hudsonius (Zimmerman)
(the Hudson Bay jumping mouse)

The frequency of occurrence of each species in 1965, and data on population size and structure are provided in Table V.

The high vole populations which were reported in 1964 collapsed during the winter and spring, and were almost absent by the fall of 1965 except on the Rennie and Pine Falls plots. The general increase in shrew populations, which has been developing during recent years, continued in 1965. By September, populations of Sorex cinereus had risen to a relatively high 4.6 per acre on the Rennie plot, and were proportionately higher on each of the other plots. The 1965 populations per acre compared with those of 1964 (in parentheses) are given in Table VI.

Richardson's ermine, Mustella erminea richardsonii Bonaparte, a predator of the shrews, mice, and voles of the study areas, was caught on three of the six plots. However, populations of the ermine were considerably lower in 1965 than in 1964 as indicated in the following comparison between the number caught in 1965 with that of 1964 (in parentheses).

	Rennie	Telford	Seddon's Corner	Pine Falls	Riverton	Darwin
M. erminea	2 (1)	1 (7)	0 (4)	0 (0)	0 (2)	1 (5)

TABLE V

Populations per acre, age, sex, breeding condition, parasitism and mortality of the small mammals in 1965.
(Per cent parasitism is given in parentheses)

Species	Plot	Pop acre	Total caught	Sex ♂♂-♀♀	Age-No.(%) J	S	A	No. in breeding condition	Parasites	Mortality
Spring Census -- (May 3-27, 1965)										
S. cinereus	#4	0.32	4	2 - 2	-	-	4(100)	2♂	-	75%
	#5	0.48	7*	3 - 2	-	-	7(100)	3♂	-	14%
S. arcticus	#5	0.13	2	1 - 1	-	-	2(100)	0	-	0%
P. maniculatus	#4	0.08	1	1 - 0	-	-	1(100)	0	-	0%
C. gapperi	#1	0.53	5	3 - 2	-	-	5(100)	3♂, 2♀	-	0%
	#3	0.09	1	0 - 1	-	1(100)	-	0	-	0%
	#4	2.13	20*	10 - 9	-	-	19(100)	3♂, 7♀	-	35%
	#5	0.37	4	2 - 2	-	-	4(100)	0	-	0%
M. pennsylvanicus	#4	0.12	1	1 - 0	-	-	1(100)	0	-	0%
	#6	0.12	1	1 - 0	-	-	1(100)	0	-	0%

Symbols: J = juvenile; S = sub-adult; A = adult; E = ear-mites; F = fleas; T = ticks; B = bots;

#1 = Rennie; #2 = Telford; #3 = Seddon's Corner; #4 = Pine Falls; #5 = Riverton; #6 = Darwin.

* Total includes specimens which were eaten beyond recognition or which escaped before examination.

TABLE V (Cont'd)

Species	Plot	Pop Acre	Total caught	Sex ♂♂-♀♀	Age-No.(%) J	S	A	No. in breeding condition	Parasites	Mortality
Fall Census -- (September 6 - October 7, 1965)										
S. cinereus	#1	4.56	57*	22-33	1(2)	52(94)	2(4)	1♀	F(2)	25%
	#2	1.68	21*	10-10	-	19(95)	1(5)	0	-	38%
	#3	0.96	14*	7-5	-	12(100)	-	0	F(7)	50%
	#4	1.60	20	9-11	1(5)	19(95)	-	0	F(10)	10%
	#5	1.03	15	7-8	-	15(100)	-	0	F(7)	20%
	#6	0.88	11	7-4	-	11(100)	-	0	-	45%
S. arcticus	#1	0.16	2	1-1	-	2(100)	-	0	-	0%
	#2	0.08	1	0-1	-	-	1(100)	1♀	-	0%
	#3	0.27	4	1-3	-	4(100)	-	0	-	25%
	#5	0.13	2	1-1	-	1(50)	1(50)	0	-	0%
	#6	0.39	5	1-4	-	5(100)	-	0	-	40%
M. hoyi	#1	0.59	7	1-6	1(14)	5(72)	1(14)	0	-	14%
	#2	0.08	1	0-1	-	-	1(100)	0	-	0%
	#3	0.14	2	1-1	-	1(50)	1(50)	1♂	-	0%
	#4	0.17	2	0-2	-	1(50)	1(50)	0	F(50)	0%
	#6	0.08	1	1-0	-	1(100)	-	0	-	0%
B. brevicauda	#1	0.45	5	2-3	-	4(80)	1(20)	1♀	-	40%
S. cooperi	#1	0.09	1	0-1	-	1(100)	-	0	-	0%
C. gapperi	#1	2.23	21	10-11	3(14)	12(57)	6(29)	1♀	E(62), F(19)	5%
	#3	0.09	1	1-0	-	1(100)	-	0	-	0%
	#4	2.87	27	9-18	-	13(48)	14(52)	0	E(4), F(33)	7%
	#5	0.09	1	1-0	-	1(100)	-	0	F(100)	0%
	#6	0.21	2	1-1	-	2(100)	-	0	E(100), F(50)	0%
M. pennsylvanicus	#2	0.35	3	1-2	2(66)	-	1(33)	0	B(33)	0%
	#6	0.12	1	0-1	-	-	1(100)	0	-	100%

Symbols: J = juvenile; S = sub-adult; A = adult; E = ear-mites; F = fleas; T = ticks; B = bots;
#1 = Rennie; #2 = Telford; #3 = Seddon's Corner; #4 = Pine Falls; #5 = Riverton; #6 = Darwin.
* Total includes specimens which were eaten beyond recognition or which escaped before examination.

TABLE VI

Peak annual small mammal populations per acre of 1965 compared with those of 1964 (in parentheses)

	Rennie	Telford	Seddon's Corner	Pine Falls	Riverton	Darwin
S. cinereus	4.56 (1.28)	1.68 (0.80)	0.96 (0.07)	1.60 (0.48)	1.03 (0.14)	0.88 (0.72)
S. arcticus	0.16 (0.31)	0.08 (0)	0.27 (0)	0 (0)	0.15 (0)	0.39 (0.23)
M. hoyi	0.59 (0)	0.08 (0)	0.14 (0)	0.17 (0)	0 (0)	0.08 (0)
B. brevicanda	0.45 (0.27)	0 (0)	0 (0.08)	0 (0.09)	0 (0)	0 (0.19)
P. maniculatus	0 (0.25)	0 (0)	0 (0)	0 (0.74)	0 (0)	0 (1.49)
S. cooperi	0.09 (0.09)	0 (0)	0 (0.15)	0 (0)	0 (0)	0 (0)
C. gapperi	2.23(10.53)	0 (1.81)	0.09 (9.45)	2.87(10.74)	0.09 (5.14)	0.21 (8.51)
M. pennsylvanicus	0 (0.95)	0.35 (2.35)	0 (0.20)	0 (0.12)	0 (0)	0.12 (0.94)

Camera Recorder Operations:

The technique of identifying photographed individuals of small mammal populations, which was introduced in 1964, was evaluated in 1965. The technique involves the use of colour-coded plastic collars on animals in the immediate vicinity of each automatic camera recorder. Photographic records are produced on 16 mm colour movie film with a single frame recorded each time a subject trips the photo-electric trigger at the bait station.

The trials in 1965 were conducted to determine the degree of identifiability of the collars on the film record, and involved eighteen specimens (8 P. maniculatus, 5 C. gapperi, 4 M. pennsylvanicus and 1 Z. hudsonius) released on an island from which the original resident population had been removed.

Analysis of the photo-records of these trials disclosed that subjects appearing on the film either (1) displayed their collar; (2) concealed the collar itself but displayed a "part" in the fur which indicated the animal was marked; or, (3) orientated themselves in such a way that the neck could not be seen at all. The 240 photo records of C. gapperi and 413 P. maniculatus were categorized as follows:

	(1) Identifiable	(2) "Part" only	(3) Cannot see
Peromyscus	50%	29%	21%
Clethrionomys	55%	25%	20%

Thus, collars were positively identified in 50% of the photos of these subjects, and in 80% of the cases, it is established at least that they do have collars.

Other species were tested, but difficulties ensued which necessitate refinements to the technique. For example, Microtus are more proficient in removing their collars than are Clethrionomys; therefore, a system must be devised for getting a better fit initially. This and other refinements form the basis of continuing studies.

A mimeographed report describing the photographic and electronic apparatus is now available.

Cocoon Predation by Small Mammals:

The cocoon planting technique is used in determining mortality in the cocoon stage of the larch sawfly caused by small mammal predators. The estimates of small mammal predation of the 1964-65 generation of larch sawfly cocoons (Table VII) were considerably higher than those of the previous generation. This was probably a result of the increase in small mammal populations in 1964.

TABLE VII

Per cent of larch sawfly cocoons of the

1964-65 generation destroyed by small mammals

	Rennie	Telford	Seddon's Corner	Pine Falls	Riverton	Darwin
Insectivores	50.0	68.2	41.0	44.0	46.0	28.6
Rodents	34.5	23.8	54.5	36.7	40.1	50.8
Total	84.5	92.0	95.5	80.7	86.2	79.4

Previous to this year, "cocoon plants" were carried out annually by C.H. Buckner. The responsibility of this work was transferred to D.G.H. Ray, the project technician, in the fall of 1964, when Dr. Buckner retrieved the 1963-64 generation of cocoons, and Mr. Ray "planted" the 1964-65 generation.

Bird Populations:

Bird populations were assessed on two of the six larch sawfly life table study sites in 1965, and population estimates of these plots are shown in Table VIII. Populations on the remaining four plots, Rennie, Telford, Pine Falls and Riverton, were not assessed in 1965 due to a staff shortage during the critical period. These will be assessed in the 1966 field season.

Bird populations at the Darwin site decreased slightly in 1965 with a reduction from 29 to 22 species and from a total population per acre of 8.73 to 8.17. Seddon's Corner populations increased very slightly from 12 species to 14, and from a total of 3.25 birds per acre to 4.23. There were no new species recorded on either plot.

TABLE VIII

Bird Populations per Acre - 1965

	Seddon's Corner	Darwin
Ruffed Grouse	P	P
Hairy Woodpecker		0.02
Yellow-bellied Flycatcher	0.10	
Least Flycatcher	0.14	0.14
Gray Jay	0.03	0.02
Blue Jay		0.02
Black-capped Chickadee		0.35
White-breasted Nuthatch		+
Swainson's Thrush	0.19	0.51
Ruby-crowned Kinglet		0.34
Cedar Waxwing	0.05	0.10
Red-eyed Vireo		0.35
Black-and-white Warbler		0.32
Tennessee Warbler	0.22	0.55
Nashville Warbler	1.30	1.83
Magnolia Warbler		0.54
Myrtle Warbler	0.15	0.43
Blackburnian Warbler		0.16
Connecticut Warbler	0.53	0.67
Yellowthroat	0.50	0.90
Cowbird	+	
Rose-breasted Grosbeak		0.02
American Goldfinch	+	+
Slate-colored Junco	0.17	0.21
Chipping Sparrow	0.52	
White-throated Sparrow	0.19	0.35
Swamp Sparrow		0.32

P = present
+ = species observed in the area but not on the plot

May 1966