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ANNUAL DISTRICT REPORT  
FOREST INSECT AND DISEASE SURVEY  
BRITISH COLUMBIA, 1978  
PART I, VANCOUVER FOREST REGION

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by  
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PACIFIC FOREST RESEARCH CENTRE  
CANADIAN FORESTRY SERVICE  
VICTORIA, BRITISH COLUMBIA

- FILE REPORT -

DEPARTMENT OF ENVIRONMENT  
February 1979

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## INTRODUCTION

This report outlines forest insect and disease conditions in the Vancouver Forest Region and forecasts trends, emphasizing pests capable of sudden, damaging outbreaks.

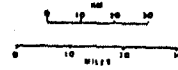
Regular field work in the Region commenced on May 15 and ended on October 27. Time expended on special surveys was as follows: 45 hours on aerial surveys in August and September (Map 2); 2 weeks on western spruce budworm egg survey and damage appraisal in August; 13 weeks on winter moth surveys to determine larval development; and 1 week on seed orchard examination for pest damage.

A total of 449 insect and disease collections were submitted to the Pacific Forest Research Centre. Map 1 shows regions and general locations of field collection points.

The number of collections containing larvae on Vancouver Island decreased from 85% in 1977 to 80% in 1978; on the Vancouver Mainland there was a decrease from 78% in 1977 to 68% in 1978.

Western spruce budworm infestations, primarily in Douglas-fir stands, showed a substantial reduction in 1978, a total of 25,200 ha, were mapped where light to moderate defoliation occurred. Mountain pine beetle infestations declined in the Klinaklini River Valley where extensive tree mortality in lodgepole pine stands has occurred for the past several years. Douglas-fir beetle attacked small pockets of Douglas-fir trees in the Fraser Canyon and Skagit River areas. Winter moth larvae again defoliated deciduous trees in the Greater Victoria area.

VANCOUVER FOREST DISTRICT

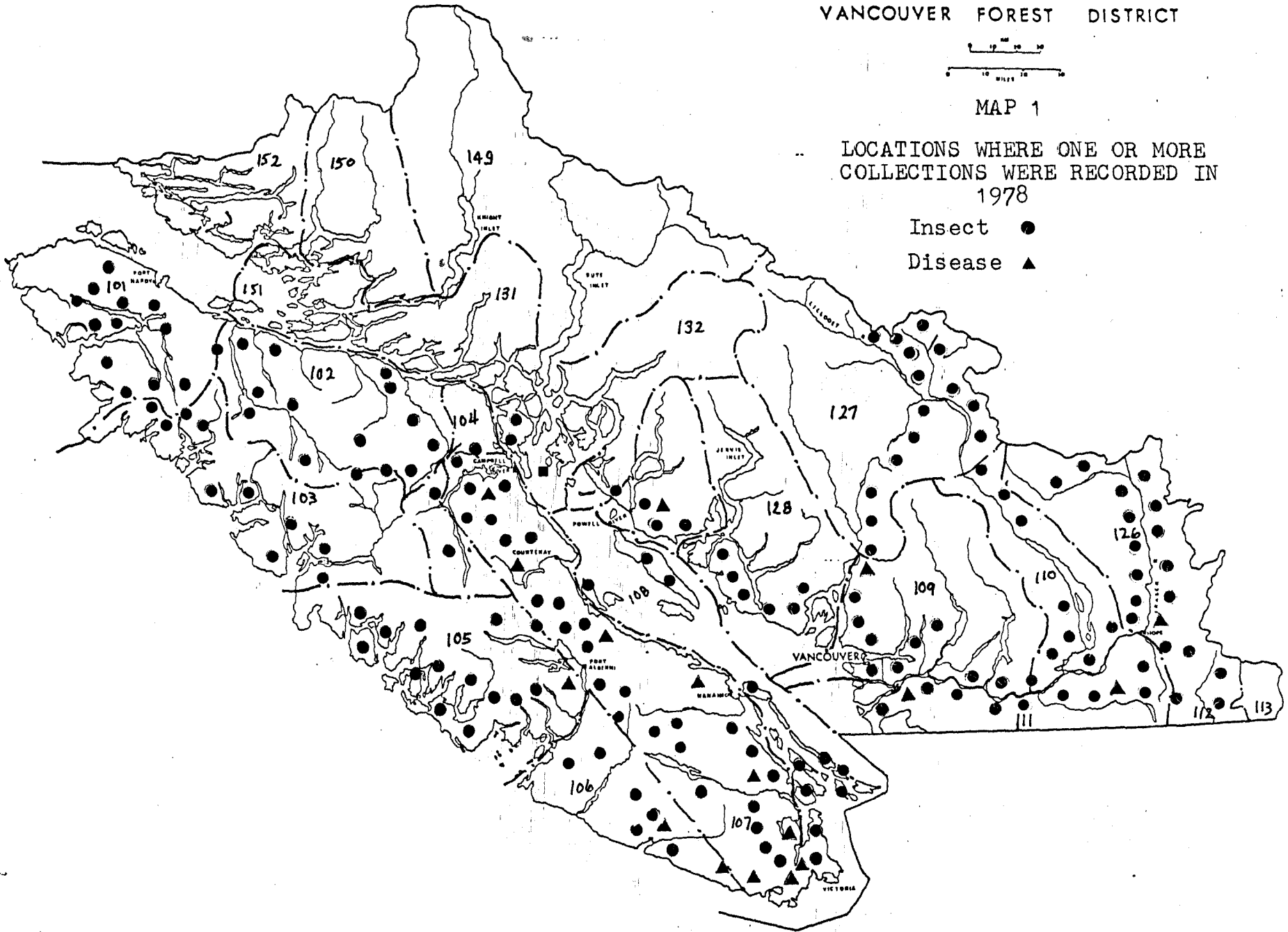


MAP 1

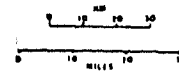
LOCATIONS WHERE ONE OR MORE  
COLLECTIONS WERE RECORDED IN  
1978

Insect ●

Disease ▲

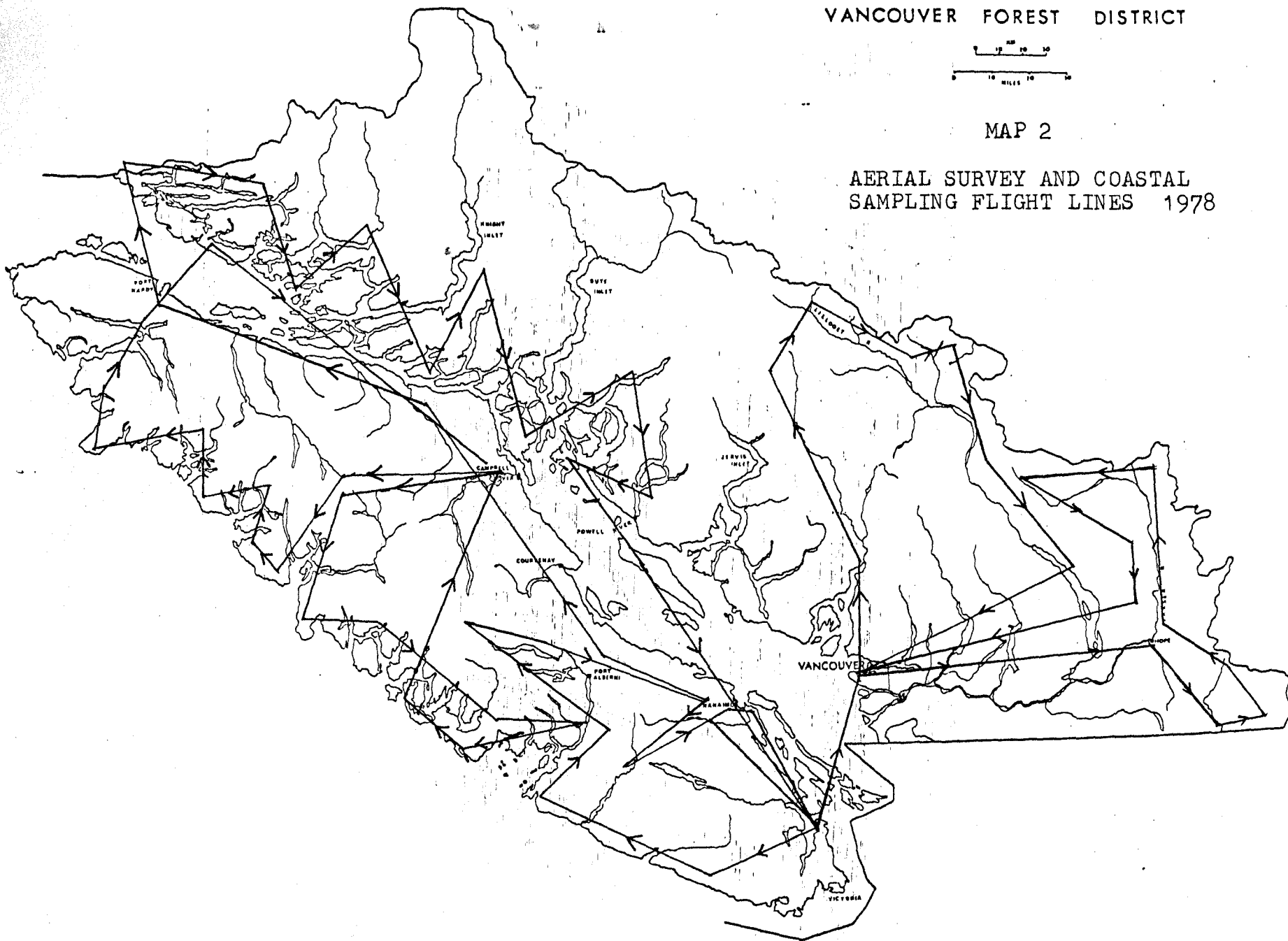


VANCOUVER FOREST DISTRICT



MAP 2

AERIAL SURVEY AND COASTAL  
SAMPLING FLIGHT LINES 1978



Douglas-fir dwarf mistletoe infections were found for the first time on Douglas-fir in coastal British Columbia, near Slesse Creek in the Chilliwack River Valley.

Drought damage primarily on Douglas-fir was widespread on Vancouver Island and Mainland.

Discoloration of broadleaf maple foliage was less severe than previous years on Vancouver Island and Mainland.

Details on individual insect and disease problems appear in subsequent sections.

#### FOREST INSECT CONDITIONS

Western spruce budworm, Choristoneura occidentalis.

Defoliation of Douglas-fir stands occurred on a total of 25,200 ha in 1978 compared with 90,170 ha in 1977. This represents a decrease of 64,970 ha. No defoliation was recorded in the Pemberton area during aerial surveys in 1978. Light to moderate defoliation occurred along the Skagit River, Coquihalla River and in the Fraser Canyon from north of Yale to Nahatlatch Lake. A small patch of heavy defoliation was recorded near Mowhokam Creek and Keefers (Map 3). One-hundred bud counts were taken on

Douglas-fir trees in infestation areas in the latter part of May, at 23 locations, for a preliminary evaluation of the infestation. Table 1 shows the results of this examination.

Map 3

WESTERN SPRUCE BUDWORM DEFOLIATION  
OF DOUGLAS-FIR  
VANCOUVER FOREST DISTRICT  
1978

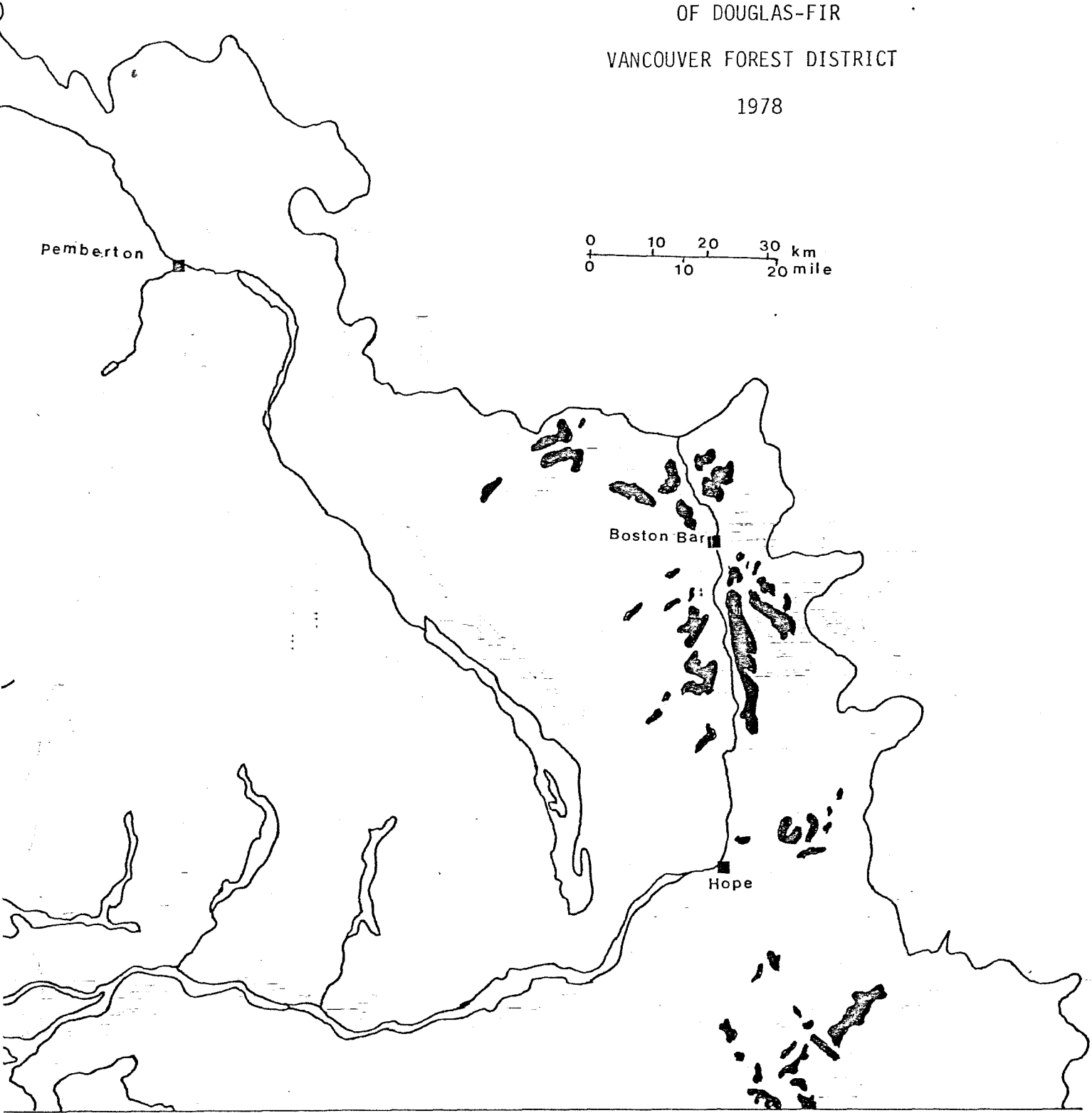


Table 1. Percentage of Douglas-fir buds infested with spruce budworm, Vancouver Mainland Section 1976, 1977 and 1978.

Locality	Percentage of buds infested		
	1976	1977	1978
<u>Fraser Canyon Area</u>			
Kookipi Cr.	-	43	20
Log Cr.	-	47	23
Nahatlatch R.	-	16	10
North Bend	-	14	4
Mowhokam Cr.	-	-	7
Anderson R.	-	50	14
Gilt Cr.	-	-	15
Spuzzum Cr.	-	26	6
Sawmill Cr.	-	-	5
<u>Hope Princeton Hwy. Area</u>			
Sumallo R.	26	31	0
Rhododendron Flats	20	40	3
Snass Cr.	-	-	3
<u>Coquihalla River</u>			
Boston Bar Cr.	-	21	16
<u>Silver-Skagit Area</u>			
Silver-Skagit Road (km 45)	25	17	20
Centennial Trail (Shawatum Cr.)	-	30	28
<u>Pemberton Area</u>			
Rutherford Cr.	34	25	3
Owl Cr.	-	16	8
Birkenhead L.	40	30	6
Haylmore Cr.	-	-	5
Railroad Cr.	22	12	1
Twin One Cr.	-	25	4
Roger Cr.	-	10	3
Joffre Cr.	-	-	3

The number of larvae taken in 3-tree beating samples from Douglas-fir showed a substantial reduction compared with 1977 (See Figure 1). Table 2 shows a summary of beating collections from Douglas-fir.

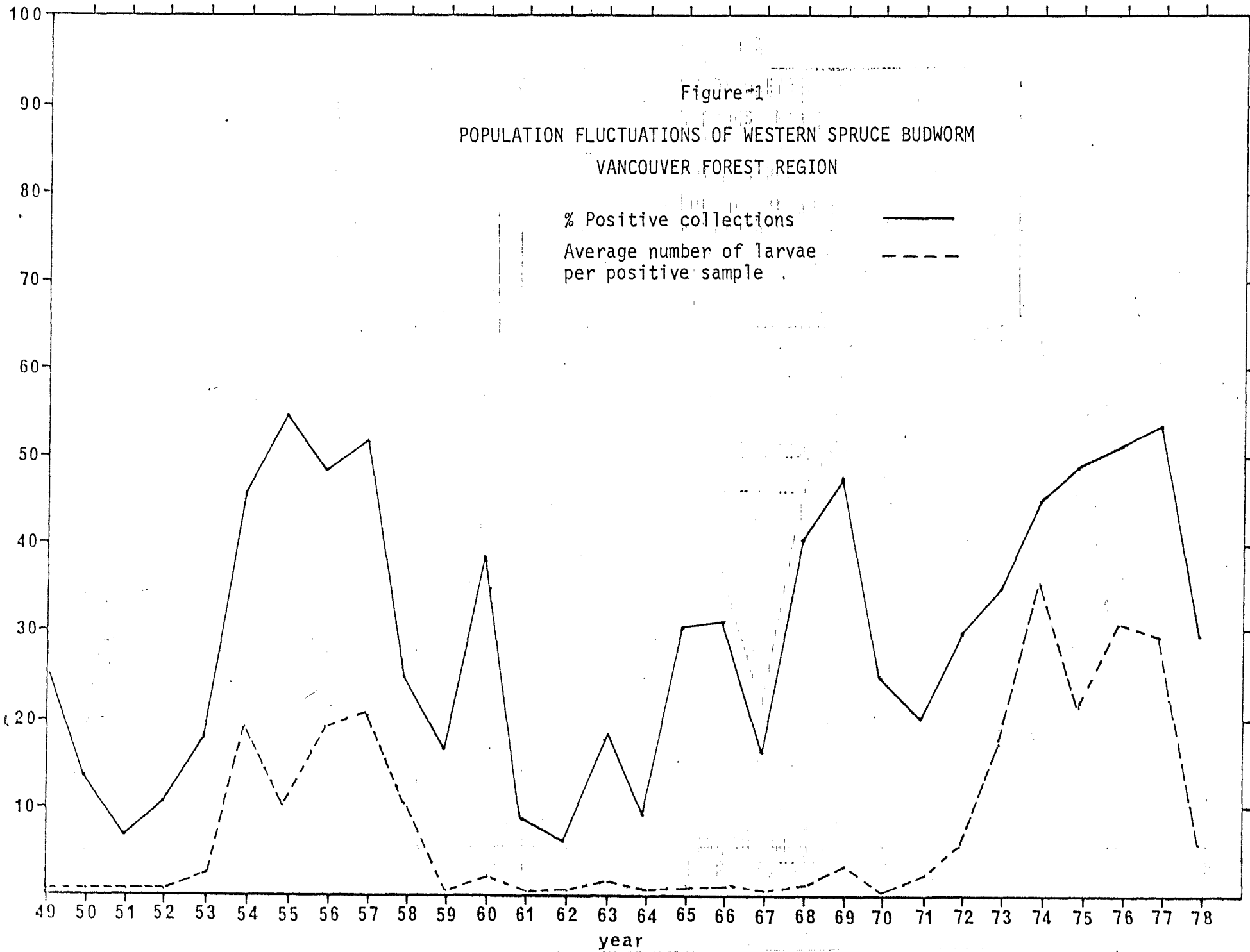




Table 2. Summary of spruce budworm beating collections from Douglas-fir, Vancouver Forest Region, 1976-78.

Region*	No. samples taken during larval period			% Samples Containing larvae			Avg. no. larvae per positive sample			Avg. no. larvae per sample		
	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978
109	7	3	4	0	0	0	0	0	0	0	0	0
110	6	3	2	33	0	0	2.0	0	0	0.6	0	0
111	5	4	8	20	0	0	1.0	0	0	0.2	0	0
112	5	4	6	100	100	83	68.6	118.0	28.8	68.6	118.0	24.0
113	3	-	-	66	-	-	1.5	-	-	1.0	-	-
126	6	6	10	50	75	60	49.3	25.6	6.5	24.6	19.2	3.9
127	12	11	19	91	78	72	75.6	47.2	1.2	69.3	37.1	.7
133	2	2	3	100	100	66	58.5	38.0	2.5	58.5	38.0	1.6
104	10	9	5	20	22	0	1.0	1.0	0	0.5	0.6	0
107	41	42	16	10	12	0	1.0	1.0	0	0.1	0.3	0

\*See map 1.

Parasitism and disease studies were done at 10 locations within the infestation in the Skagit River, Fraser Canyon and Pemberton areas as shown in tables 3 and 4.

Table 3. Percent parasitism of western spruce budworm reared in 1978, Vancouver Mainland Section.

Location	Total Budworm		% Actual Parasitism			Overall % Parasitism	
	Collected	Reared	L3+L4	L5+L6	Pupae	Larvae	Larvae & Pupae
Skagit R.	254	112	29	20	-	43	-
Sumallo R.	11	5	-	33	-	20	-
Snass Cr.	269	124	24	15	3	35	37
Skagit R. (Upper)	326	147	48	9	16	53	60
Gilt Cr.	254	103	21	29	-	44	-
Anderson R.	281	97	67	32	18	78	82
E. Anderson R.	303	78	25	22	33	41	61
D'Arcy	264	98	100	74	-	82	-
Phelix Cr.	77	34	14	75	-	78	-
Haylmore Cr.	95	44	88	63	-	92	-
	4515	1910	44	26	25	59	68

overall % =  
parasitism

$$\left[ \frac{(1 - \% \text{ parasitism } L3+L4)}{100} \frac{(1 - \% \text{ parasitism } L5+L6)}{100} \frac{(1 - \% \text{ parasitism pupae})}{100} \right] \times 100$$




Table 4. Assessment of micro-organisms within western spruce budworm populations, Vancouver Mainland Section, 1978.

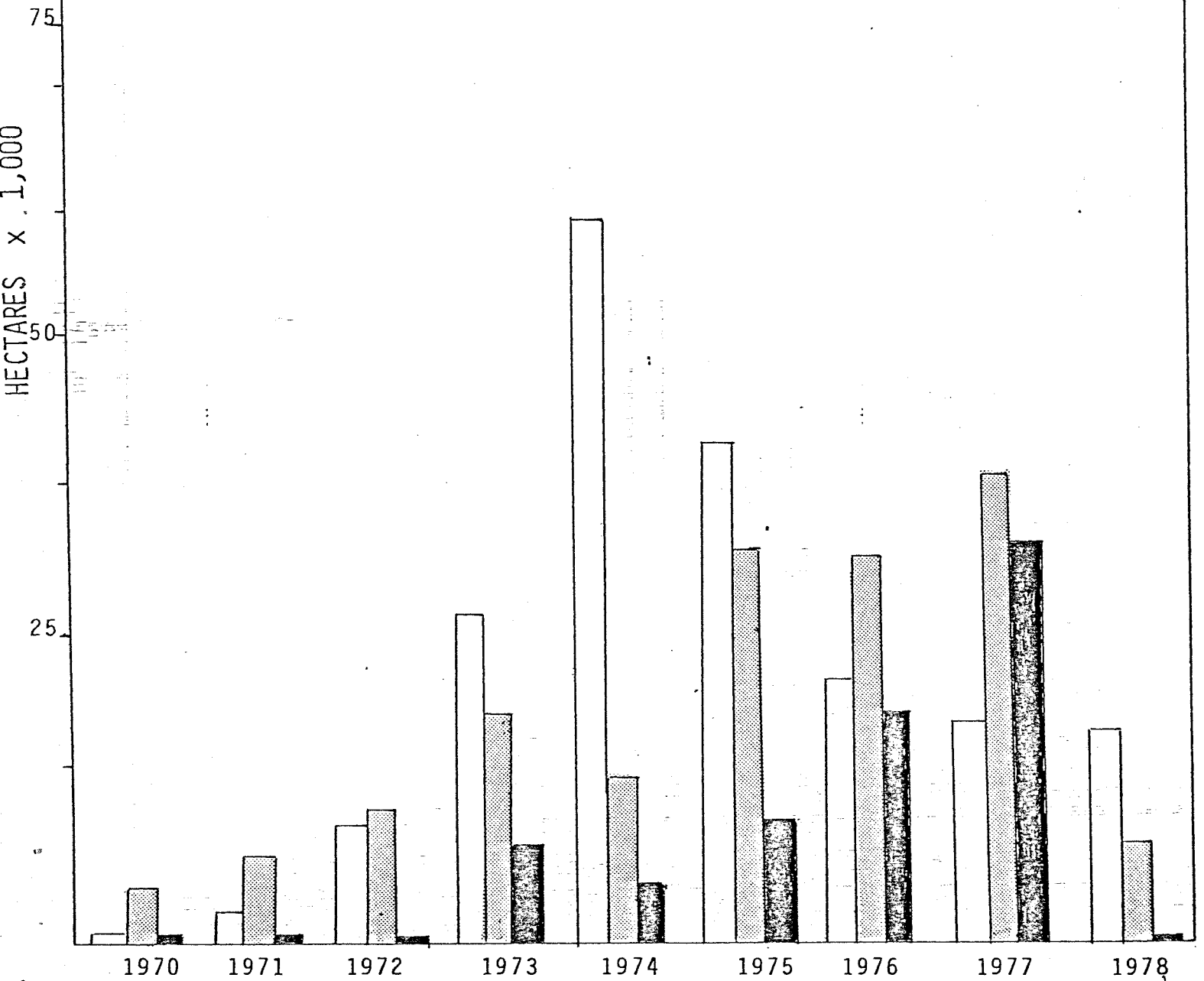
Location	Date collected	No. of larvae	Remarks
<u>Nahatlatch River</u>			
Kookipi Cr.	16-V-78	25	Negative
Log Cr.	16-V-78	25	"
Nahatlatch Bridge	16-V-78	25	"
<u>Fraser Canyon</u>			
Spuzzum Cr.	18-V-78	25	"
Gilt Cr.	18-V-78	25	"
Anderson R.	18-V-78	25	"
North Bend	16-V-78	25	"
<u>Skagit River</u>			
Silver Skagit (km 45)	17-V-78	25	"
Centennial Trail (Shawtum Cr)	17-V-78	25	"
Rhododendrum Flats	18-V-78	25	"
Boston Bar Cr.	17-V-78	25	"
<u>Pemberton Area</u>			
Tisdal	23-V-78	25	Nucleopolyhedrosis Virus
Owl Cr.	23-V-78	25	Negative
Birkenhead L.	23-V-78	25	"
Haylmore Cr.	23-V-78	25	"
Twin One Cr.	24-V-78	25	"
Roger Cr.	24-V-78	25	"

Aerial surveys early in August showed a substantial decrease in areas of defoliation in 1978 compared with 1977. The largest reductions occurred in the heavy and moderate defoliation categories (see Figure 2). The only heavy defoliation occurred in the Fraser Canyon near Mowhokam Creek and Keefers where 500 ha were defoliated. Moderate and light defoliation was recorded on 8600 ha and 16100 ha respectively in the Fraser Canyon and tributary valleys from Yale to Nahatlatch Lake and along the Skagit and Coquihalla rivers (Table 5).

Figure 2

SPRUCE BUDWORM DEFOLIATION  
VANCOUVER FOREST DISTRICT,  
1970 - 1978

-  LIGHT
-  MEDIUM
-  HEAVY



For the first time since 1969 no visible defoliation was recorded in the Pemberton area, although light defoliation was evident during ground surveys at Owl Creek, Haylmore Creek and Birkenhead Lake.

An assessment of the egg population was made in August by counting egg masses on two 46-cm branches from the mid-crown of each of 10 Douglas-fir trees at each of 20 locations and 3 Douglas-fir trees at each of 14 locations. The prediction for 1979 defoliation is based on the criterion that up to 50 egg masses per 10 m<sup>2</sup> of foliage could result in light defoliation (up to 30% of the foliage lost); from 50 to 150 egg masses in moderate defoliation (from 35 to 70% of foliage lost); and more than 150 egg masses in heavy defoliation (more than 75% of foliage lost).

Defoliation estimates taken on trees at each of the egg sample plots showed that the heaviest defoliation occurred along the upper and lower Skagit River, Shawatum Creek, and Sawmill Creek (Table 6).

Table 5. Areas of spruce budworm defoliation of Douglas-fir, Vancouver Mainland Section, 1978.

Location	No. hectares defoliated		
	Light	Moderate	Heavy
Skagit R.	4052	4086	0
Coquihalla R.	582	1010	0
Fraser Canyon (Yale to North Bend)	6012	2534	0
East Anderson R.	1542	0	0
Anderson R.	1311	0	0
Nahatlatch R.	1112	259	200
Nahatlatch L.	1036	64	0
Mowhokam Cr.	453	647	300
<b>Totals</b>	<b>16100</b>	<b>8600</b>	<b>500</b>

*Grand total 25,200 ha*

The condition of Douglas-fir was assessed in 18 stands within the infestation. All stands had apparent damage and in 3 areas tree mortality was high, but such areas were representative of less than 1% of the infestation.

Top-kill is extensive in 35- to 90-year-old stands defoliated for more than two consecutive years and generally increases with the number of years and severity of feeding. Recovery of normal height growth and the development of a dominant leader will probably require several years varying with the severity of the top-kill.

Tree mortality was not significant in most of the infested area. Substantial mortality occurred only in a few 40 to 250 ha stands which were severely ~~defoliated~~ <sup>defoliated</sup> early in the infestation. Most severely damaged were stands at Tsileuh Creek where 31% of the trees had died (12% were attacked by bark beetle) and 4% had current beetle attacks. Along Trafalgar Creek 71% of the trees were killed. A stand at Rutherford Creek, in part of which mortality reached 53% of the trees, has been salvaged logged.

To date, mortality not associated with bark beetles, has only occurred in two stands at Gilt Creek (2 and 5%) and in the East Anderson River (1%). However, current bark beetle attacks were observed for the first time in five stands: Nahatlatch River - 5%, Gilt Creek - 1 and 2%, East Anderson - 3%, and Skagit - 2%.

For a more detailed report on spruce budworm in the Vancouver Forest Region, see D.A. Ross, G.A. Van Sickle, R.L. Fiddick and D.G. Collis Report October 1978 (Appendix 1), Status of Western Spruce Budworm on Douglas-fir in British Columbia.

Table 6. Spruce budworm egg masses and defoliation estimates on Douglas-fir trees, Vancouver Mainland Section, 1978.

Plot No.	Location	Avg no. egg masses per 10 m <sup>2</sup> of foliage			Estimated loss of current year's foliage %			Estimated total defoliation %			Predicted defoliation for 1979
		1976	1977	1978	1976	1977	1978	1976	1977	1978	
401	Nahatlatch L (10) (west end)	684	44	0	75	0	trace	10	0	1	nil
402	Nahatlatch (10) ( <i>Chaumox</i> )	684	95	0	18	45	trace	13	15	1	nil
403	Log Cr (10)	432	161	0	78	95	10	10	15	5	nil
404	Kookipi Cr (3)	1035	434	0	75	95	13	8	15	13	nil
405	Uztlius Cr (km 27)(3)	765	102	0	93	80	trace	30	20	13	nil
406	Stoyoma Cr Rd. (3)	720	104	0	95	95	trace	26	30	15	nil
407	East Anderson R (10)	810	207	0	72	95	10	25	30	13	nil
408	Anderson R (km 8.8)(10)	576	128	8	93	95	trace	41	25	0	light
409	Alexandria (Gilt Creek)(10)	180	123	7	95	85	3	45	25	24	light
410	Spuzzum Cr (km 4.8)(3)	837	0	0	91	90	trace	56	25	2	nil
411	Spuzzum Cr (km 16.8)(3)	927	0	0	63	90	0	15	20	13	nil
412	Scuzzy Cr (km 15.2)(3)	423	243	0	93	95	10	50	45	26	nil
413	Sawmill Cr (10)	441	0	18	86	70	33	36	10	10	light
414	Cedar Cr (3)	576	62	0	63	70	33	36	10	16	nil
415	Rhododendron Flats (10)	207	101	52	84	100	21	17	45	28	moderate
416	Boston Bar Cr (10)	60	60	16	86	65	trace	11	10	2	light
417	Ladner Cr (10)	222	114	6	91	75	4	20	25	22	light
418	Sumallo R #1(10) (Hope Slide)	10	54	29	1	5	trace	13	25	11	light
419	Sumallo R #2(3)	271	63	0	91	10	5	21	40	26	nil
420	Snass Cr (3)	162	214	10	71	85	6	10	20	11	light
421	Centennial Trail (10) ( <i>Shawatum Cr</i> )	189	74	0	79	80	30	15	30	16	nil
422	Nepopekum Cr (10)	28	0	0	60	1	0	5	1	0	nil
423	Silver-Skagit Rd (3) (km 44.8)	135	59	0	60	40	20	5	15	8	nil
435	Mowhokam Cr (10)	-	123	20	-	80	2	-	20	22	light
424	Birkenhead L (10)	358	62	0	94	75	2	63	45	3	nil
425	Gates R (10)	432	118	0	55	25	1	13	10	10	nil
426	Haylmore Cr (10)	513	197	0	49	60	trace	13	20	trace	nil
427	Owl Cr (10)	1260	54	0	83	80	0	11	15	0	nil
428	Rutherford Cr (3)	1116	132	0	75	55	trace	26	15	trace	nil
429	Green R (3)	792	22	0	85	45	0	16	10	0	nil
430	Twin Cr (10)	324	39	0	11	5	trace	1	5	trace	nil
431	Roger Cr (3)	81	30	0	0	1	0	0	1	0	nil
432	Skookumchuk (3)	28	0	-	0	0	-	0	0	-	-
433	Railroad Cr (10)	261	19	0	25	45	trace	28	20	trace	nil

Light - defoliation up to 50 egg mass per 10 m<sup>2</sup>  
 Moderate - defoliation up to 51-150 egg mass per 10 m<sup>2</sup>  
 Heavy - defoliation up to 151 + egg mass per 10 m<sup>2</sup>

Flight traps baited with a sex attractant, (Trans-11-tetradecenal, 3% by weight), were used to assess adult male budworm populations. The attractant was impregnated into plasticized cylindrical cores 4 mm in diameter, then cut into 10 mm lengths with each length containing 4 mg of attractant. One section was placed in each trap, which consisted of 2.3 litre milk cartons with the ends cut out. Each trap was 10 X 10 X 24 cm and had a sticky trapping surface of 1000 cm<sup>2</sup>. The traps were set out in mid July and retrieved late in August after the moth flight was over. Table 7. shows a comparison of the number of adults caught in 1976, 1977 and 1978.

Spruce budworm eggs were present in only 9 of 34 locations sampled in 1978, with all but 1 in the light defoliation category. Defoliation may continue at moderate levels at Rhododendron Flats (Hope Princeton Highway) with scattered pockets of light defoliation at Anderson River, Gilt Creek, Sawmill Creek, Boston Bar and Ladner creeks (Coquihalla River), and Sumallo River.

No spruce budworm larvae were collected in beating samples in forested areas on Vancouver Island. However, moderate numbers of larvae were found in Douglas-fir seed orchards at Duncan and on the Saanich Peninsula.



Table 7. Western spruce budworm\* adult males in pheromone-baited traps, Vancouver Forest Region.

Location	Larval population density			No adults in traps								
	1976	1977	1978	Range			Total			Avg.		
				1976	1977	1978	1976	1977	1978	1976	1977	1978
Thetis L	nil	nil	nil	74-122	10-31	9-31	511	97	103	102	19	21
Green Mtn	nil	nil	nil	8-17	16-61	15-35	67	163	115	13	33	23
Fuller L	nil	nil	nil	19-60	8-29	10-26	160	90	104	40	18	21
Skagit R	moderate	moderate	light	29-39	22-38	32-78	139	162	243	28	32	48
Sumallo R	heavy	heavy	light	15-27	44-56	30-60	86	254	177	17	51	44
Spuzzum Cr	moderate	moderate	light	48-134	28-53	20-88	377	204	287	75	41	57
Rutherford Cr	moderate	moderate	light	35-64	23-45	15-33	222	164	114	44	33	22
Haylmore Cr	heavy	moderate	light	29-135	19-35	35-71	348	135	241	69	27	48
Birkenhead L	heavy	heavy	light	18-26	17-26	35-62	110	115	238	22	27	47
Haig Hwy (Hope)	-	light	nil	-	4-13	46-76	-	171	326	-	34	65
Boston Bar Cr	-	-	moderate	-	-	42-71	-	-	249	-	-	62
Gilt Cr	-	-	moderate	-	-	26-52	-	-	205	-	-	41
Kookipi Cr	-	-	moderate	-	-	44-86	-	-	345	-	-	69
Duncan	-	-	nil	-	-	5-14	-	-	53	-	-	11
East Saanich	-	-	nil	-	-	3-11	-	-	40	-	-	8

\* Assumed to be *C. occidentalis*

Western blackheaded budworm, Acleris gloverana

Populations of the western blackheaded budworm increased in western hemlock and amabilis fir stands on the west coast of Vancouver Island from Tofino to Brooks Peninsula. The average number of larvae per positive 3-tree beating sample increased 5-fold as compared with 1974 to 1977 (See figure 4). Collections containing up to 70 larvae were taken at Ououkinsh and Nasparti inlets. Collections in the Mainland section remained low.

Between 1926 and 1973 there have been 4 major outbreaks of black-headed budworm in the Vancouver Forest Region. Usually infestations appeared first in the Mainland section occurring 1 or 2 years later on Vancouver Island. In each infestation parasites, virus diseases or adverse weather conditions reduced the populations after 2 or 3 years of heavy defoliation. Very little tree mortality occurred with 1 exception, in 1944 in the Salmon River Valley. Table 8 compares the Vancouver Island and Mainland outbreaks as recorded in the History of Population Fluctuations and Infestations of Important Forest Insects in the Vancouver Forest Region.

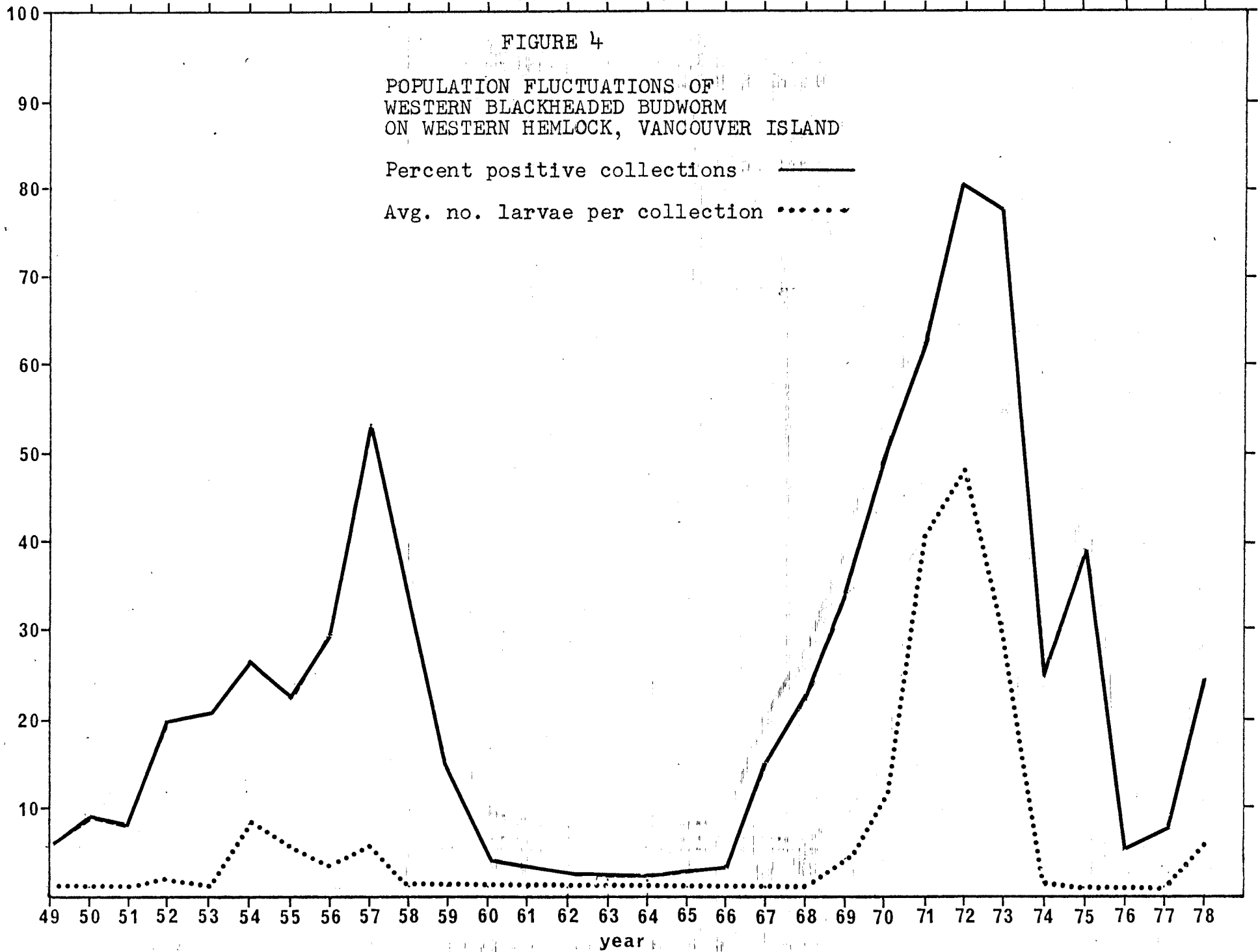


Table 8. Years in which heavy defoliation by western blackheaded budworm were recorded, Vancouver Forest Region.

Vancouver Mainland	Vancouver Island
1926-30	1929, no records 1930, infestations subsided
1940-41	1943-44 <sup>1/</sup>
1952, infestation aborted 1956, infestation aborted	1953-57
1966-70	1967-73
1978, no increase noted	1978, populations increasing

<sup>1/</sup> Mortality of western hemlock and amabilis fir trees recorded in Salmon River Valley in 1944.

Testing of sex attractants to measure the male adult populations continued for the fifth year. Eleven locations were sampled with five traps containing the pheromone trans-11-tetron decenal (CSC 72) set out at each location. Results are shown in Table 9.

Table 9. Number of male adult western blackheaded budworms collected in pheromone traps, Vancouver Forest Region.

Location	Total no. traps			Bait	No. adults trapped			Avg		
					Total					
	1976	1977	1978		1976	1977	1978	1976	1977	1978
<u>Vancouver Island</u>										
Marshall Cr	5	5	4	CSC 72	3	27	18	0.75	5.4	4.5
Dunsmuir Cr	5	5	5	"	5	29	34	1.0	5.8	6.8
Loss Cr	5	5	5	"	10	41	29	2.0	8.2	5.8
Gracie L	5	5	5	"	18	153	142	3.6	30.6	28.4
Zeballos	5	5	5	"	35	6	0	7.0	1.2	0
Kelsey Bay	5	5	5	"	33	87	50	6.6	17.4	10.0
Port McNeill	5	5	5	"	12	66	34	2.4	13.2	6.8
Port Alice	5	5	5	"	125	418	19	25.0	83.6	3.8
Holberg	4	5	5	"	12	32	0	3.0	6.4	0
<u>Vancouver Mainland</u>										
Silver Tip (Sumallo R)	-	5	5	"	-	0	0	-	0	0
Coquihalla R	-	-	5	"	-	-	0	-	0	0

Green-striped forest looper, Melanolophia imitate

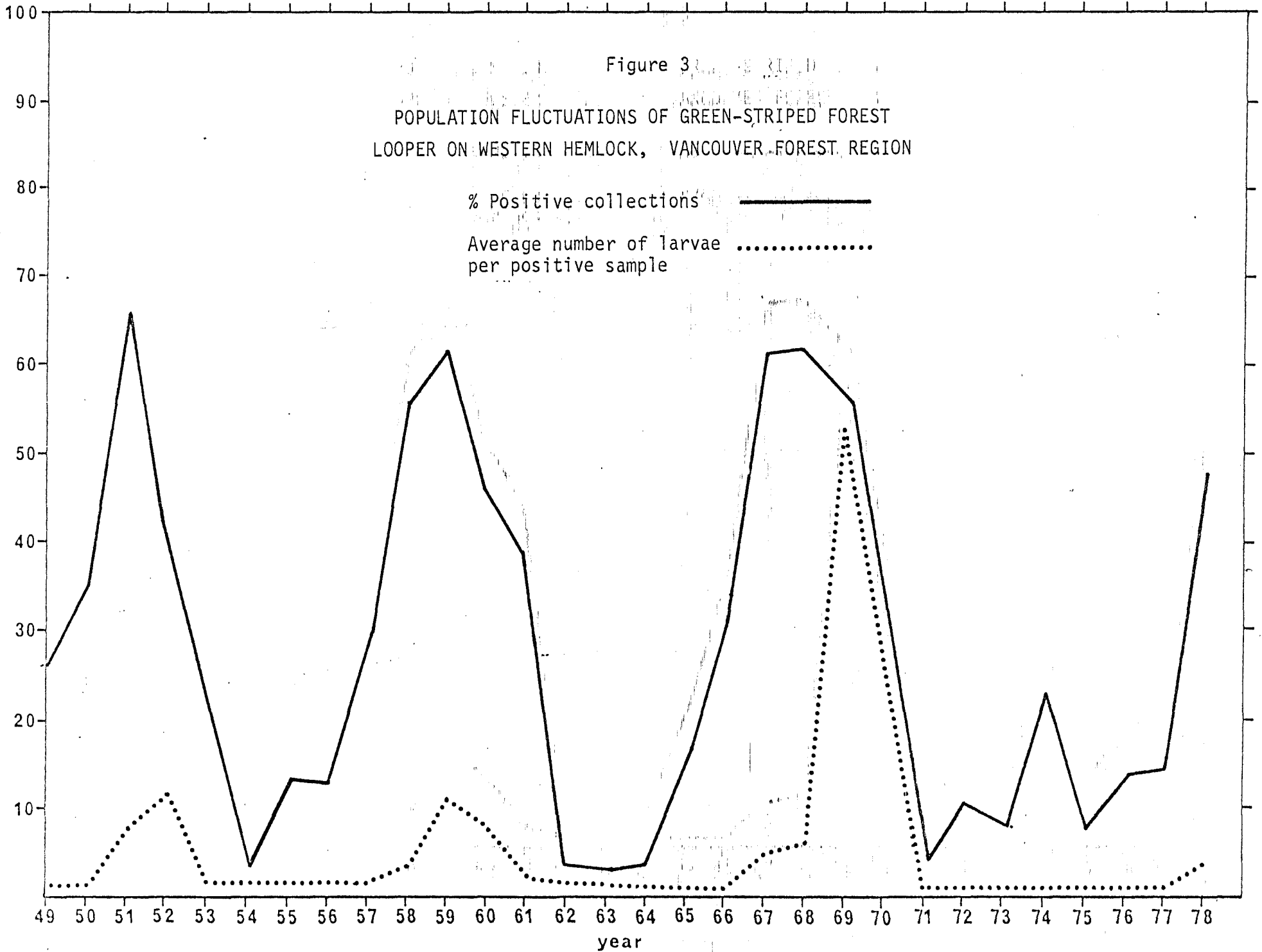
Larvae were common in small numbers in hemlock-cedar stands throughout the Vancouver Forest Region for the first time since 1970. Historically, large population build-ups have occurred at approximately 10-year intervals (see figure 3). On Vancouver Island 3-tree beating samples containing from 15 to 40 larvae were taken in an area forming a rough triangle from Parksville to Courtenay to Port Alberni. On the Mainland the largest populations occurred from Sechelt to Lund.

A 3-year comparison of the number of larvae in 3-tree beating

Figure 3

POPULATION FLUCTUATIONS OF GREEN-STRIPED FOREST  
LOOPER ON WESTERN HEMLOCK, VANCOUVER FOREST REGION

% Positive collections —————  
Average number of larvae  
per positive sample .....



No samples taken during larval period			% samples containing larvae			Avg no. larvae per positive sample		
1976	1977	1978	1976	1977	1978	1976	1977	1978
145	142	91	14	20	43	1.5	1.8	3.3

Winter moth, Operophtera brumata

Winter moth again caused extensive defoliation of Garry oak, maple and many other deciduous tree species on southern Vancouver Island in 1978. The most severe damage occurred in Greater Victoria, notably around Gonzales Point, Cattle Point and from Mount Tolmie to Christmas Hill. Smaller, scattered patches of defoliation were recorded in Sidney, south of Elk and Prospect lakes and in Esquimalt and Metchosin.

In March and April, 1978, branches were collected from Garry oak at Cattle Point and examined for winter moth eggs. The samples showed that more than 30% of the eggs were hatched by the end of March and by April 10, all had hatched (see Figure 5).

During the summer, collections of winter moth larvae were taken at regular intervals to record larval development in order to determine the optimum time for release of parasites planned for southern Vancouver Island in 1979.

Infested branch tips of Garry oak were bagged and the larvae collected as they left the branches and preserved in 75% alcohol. Head capsules of nine larvae from each collection were measured in the fall of 1978 and the larvae were grouped into instars, with some adjustments, as per head widths of winter moth larvae in Nova Scotia (Table 10).

Table 10 Head capsule widths of winter moth larvae in Nova Scotia

Larval instar	Range of head widths (mm)
1	0.21 - 0.25
2	0.39 - 0.42
3	0.56 - 0.67
4	0.88 - 1.05
5	1.51 - 1.61

Table 11. Head capsule widths and instar grouping of winter moth larvae in British Columbia, 1978 (Appendix 2).

Date	Range of head widths (mm)	% larvae by instar				
		1	2	3	4	5
April 3	0.198-0.23	66	34	0	0	0
April 15	0.43 -0.66	0	34	66	0	0
April 27	0.49 -0.92	0	0	44	56	0
May 3	0.53 -0.957	0	0	56	44	0
May 15	0.66 -1.45	0	0	11	89	0
May 23	1.29 -1.45	0	0	0	100	0
May 30	1.32 -1.95	0	0	0	56	44

Larval collections in 1978, according to the aforementioned study, showed that populations at Cattle Point consisted of first, second and third instar larvae until mid-April. From then until the third week of May, most larvae were in fourth instar and by the end of May almost 50% were in fifth instar Table 11, Figure 6. The first pupa was collected on May 20 and after that date branch samples yielded no larvae, presumably because they had dropped to the ground to pupate.

All larval collections for this study were made at Cattle Point, one of the most severely infested locations in the City.



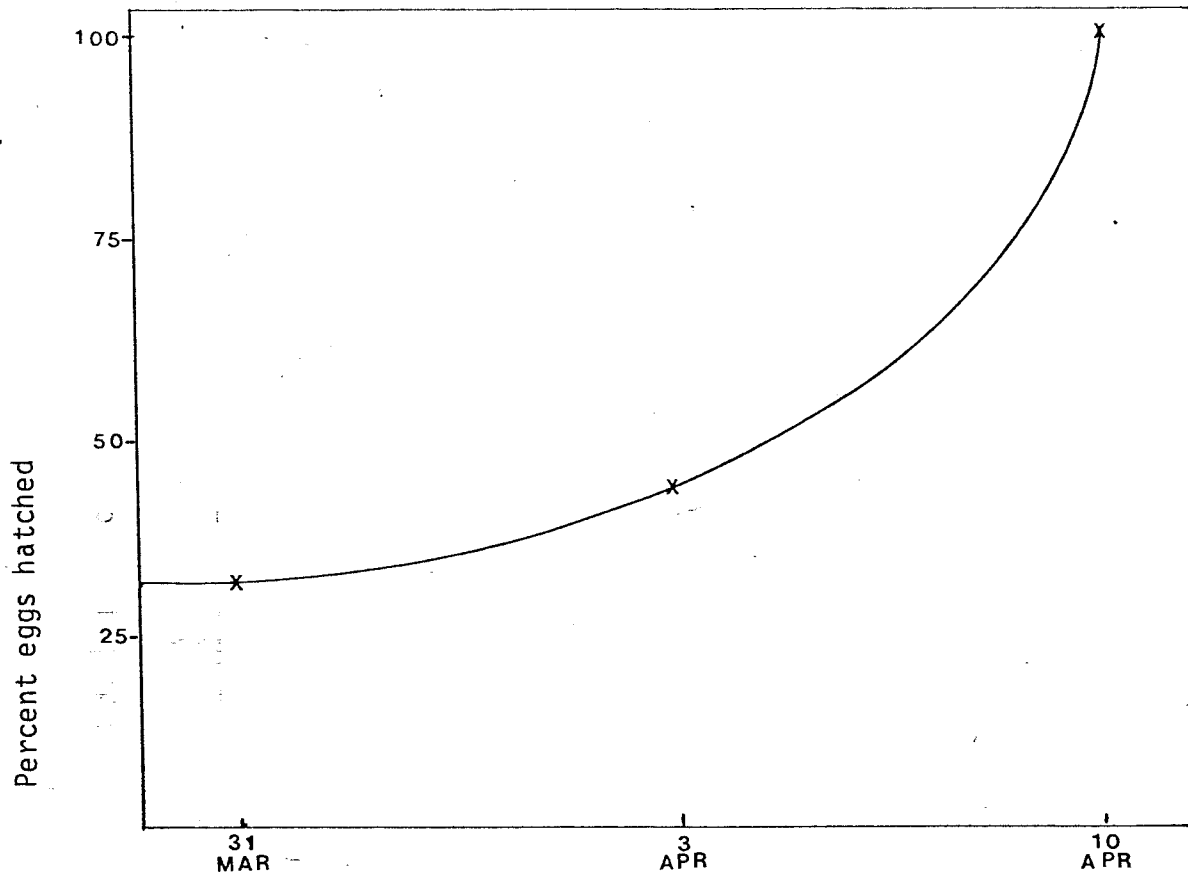


FIG 5 Collection dates -

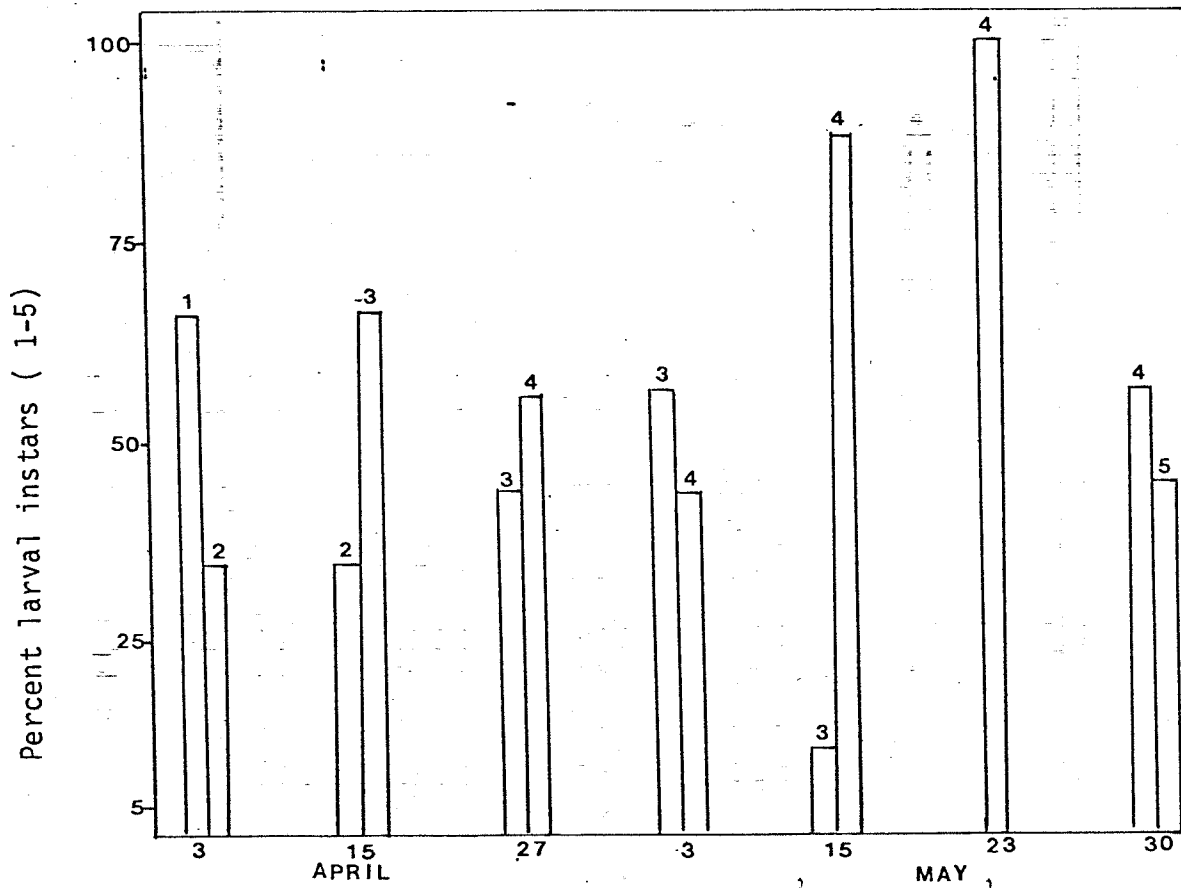


FIG 6 Collection dates

There was no evidence of disease in mass collections of larvae taken at three widely-separated locations and submitted to the Insect Pathology Research Institute at Sault Ste. Marie, Ontario.

In October, several days were spent assisting the Plant Quarantine Branch of the Canada Department of Agriculture in setting out winter moth traps at commercial nurseries in Victoria, Sooke, Duncan, Nanaimo and Campbell River to determine the distribution of the insect in those areas. The traps used were Gypsy moth traps cut into sections to fit the diameter of smaller trees (less than 6 cm d.b.h.) or used whole on larger trees (up to 35 cm d.b.h.). Traps were placed on the base of the stem of individual trees and held in <sup>place</sup> ~~place~~ by string and/or masking tape. The exposed surface of the traps were coated with tanglefoot, which entangled the female winter moth adults as they climbed the bole to lay eggs. Winter moth adults were found in traps set out at Victoria, Duncan and Nanaimo, which extends the known range of the winter moth on Vancouver Island.

On the Vancouver Mainland, 800 traps were set out in the Greater Vancouver area and in the Fraser Valley as far east as Agassiz-Rosedale. The results of this survey have not been completed.

European pine shoot moth, Rhyacionia buoliana, continued to cause light damage to ornamental pine trees on southern Vancouver Island and in some southern areas of the mainland section of the Vancouver Forest Region. Flight traps were used as in previous years to determine the presence of the insect at a number of locations in Victoria and Vancouver. The traps consisted of a 2-litre size milk carton with ends removed, cut along one side and refolded to form a 3-sided triangular cage coated on the inside with bird tanglefoot which caught and retained the male moths attracted to the synthetic sex attractant bait. Table 12 shows the results of the project.

Table 12. European pine shoot moths in flight traps, Vancouver Forest Region, 1978. (Appendix 3).

Location	Av no moths per trap
Haultain Ave*	16
University of Victoria*	31
Ross Bay*	1
University of B.C.**	4
Langara Golf Course**	24
Deas Island Tunnel**	18

\* Vancouver Island areas

\*\* Mainland areas

The results in Table 12 were obtained from using 4% Daterman sex attractant. Traps baited with 5% Gray and 0.05% Gray were less successful, although they did attract some moths. Traps were also set out near Hope and at the Chilliwack River Nursery south of Chilliwack but failed to catch any moths. Both of the latter areas were beyond the known range of the insect. Pine trees infested by the shoot moth have been recorded east of Vancouver as far as Abbotsford.

The major threat from the shoot moth is to pines planted as ornamentals in residential areas of Vancouver and Victoria. The population in Vancouver is heaviest at the Langara Golf Course on Ontario Street and will probably persist for some time if no control is undertaken. In Victoria the moth population on the University grounds persists even though some spraying has been conducted.

Douglas-fir beetle, Dendroctonus pseudotsugae

A total of 481 red-topped Douglas-fir trees were recorded during aerial surveys at 13 localities in the Fraser Canyon, Skagit River and Pemberton area. Table 13 shows the localities and the number of red-tops counted.

Table 13 Estimated Number of Douglas-fir Tree killed by Douglas-fir beetle as determined by aerial surveys, Vancouver Mainland Section, 1978.

Location	No. red tops
Anderson R	21
East Anderson R	38
Uztlus Cr	33
Snass Cr	60
Skagit R	184
Skaist R	13
Spuzzum Cr	6
Tsileuh Cr	22
Scuzzy Cr	9
Speyum Cr	15
Pemberton Meadows	28
Railroad Cr	30
Lillooet L	22
Total	481

Douglas-fir beetle attacks in spruce budworm defoliated stands has not been significant in most of the defoliated stands. At Tsileuh Creek 12% of the trees were killed by beetles, and 4% were currently infested in a 250 ha Douglas-fir stand heavily defoliated by spruce budworm. Current bark beetle attacks were also observed for the first time in 5 stands where cruise strips were run; Nahatlatch River 5%, Gilt Creek 1 and 2%, East Anderson River 3% and Skagit River 2%.

The British Columbia Forest Service conducted a survey to determine the feasibility of a trap tree program being done in 1979. The purpose of the survey conducted in 1978 was to locate and describe pairs of infestations. Infestations were to consist of 1978-attacked trees and should be at least 2 km apart, and 2 km from any other infestation. Each member of a pair of infestations (one to be treated and the other left as a check) were to be similar as possible in terms of numbers of 1978-attacked trees, stand type, and aspect.

A total of 16 sites were located in the Hope Ranger District, 5 sites in the Pemberton Ranger District and 1 site in the Squamish Ranger District. For a more detailed report on this survey (see appendix 4).

A special bark beetle survey was conducted by the British Columbia Forest Service at Shovelnose Creek in the Squamish River Valley in preparation for a salvage and trap tree program in 1979. The infested stand covers 52 ha and is between 50 to 80 years old. Bark beetle populations were detected in drought stressed trees in the spring of 1978. In November strips were run in the stand at 30 m intervals and all infested trees recorded. A total of 101 currently infested trees were found on the east side of the Squamish River and 14 on the west side. Population sampling was done by removing 935 sq. cm bark samples and the number of adults, larvae and pupae counted. A moderate beetle population was found mostly in the adult stage.

The number of weakened Douglas-fir trees in the stand caused by drought was about 5 times the number of trees currently infested. For a more detailed report and map on the survey carried out at Shovelnose Creek see A. Renwick Douglas-fir Beetle Report November 14, 1978 (Appendix 5).  
Mountain pine beetle, Dendroctonus ponderosae

Mountain pine beetle infestations declined along the Klinaklini River drainage in 1978. A total of 1500 red-topped lodgepole pine trees were recorded from Remote Creek to Klinaklini Lake, compared with 4,000 red-tops in 1977. This is the fifth year tree mortality has been observed in this area. In 1974, 10,300 red-tops were counted; in 1975, 40,000, 1976, 1800 and in 1977 4,000.

At Haylmore and Spruce creeks near Anderson Lake 530 lodgepole pine red-tops were counted. Scattered red-topped western white pine totaling 150 trees were observed in the Birkenhead Lake area and at Joffre Creek near Lillooet Lake.

Scattered lodgepole pine red-tops totalling 350 trees were recorded at Mowhokam Creek. Some of the previous years infested areas have been logged in conjunction with the regular logging plans for the area.

Fir engraver beetle, Scolytus ventralis

During aerial surveys in August dying mature amabilis fir trees were noted along the coastline of Vancouver Island and the Mainland. Although no ground examinations were done it is thought that tree mortality was caused by a fir engraver, root rot and drought complex. Table 14 shows the location and approximate number of dying amabilis fir.

Table 14. Dying amabilis fir, Vancouver Forest Region, 1978.

Location	Est. no. trees
<u>Vancouver Mainland</u>	
Wakeman R	75
Kingcome Inlet	200
Thompson Sound	50
Kakweiken L	25
Mt. Scriven	100
Phillips R	450
Phillips L	150
Mt. Gardiner	125
Read Isl	50
Powell R	300
Eldred R	75
<u>Total</u>	<u>1,600</u>
<u>Vancouver Island</u>	
Tahsish R	100
Tsitika Mtn	50
Harris L	50
Mt. Guemes	200
Clayoquot R	500
Kennedy R	700
Mt. Gibson	200
Klitsa Mtn	400
Nahmint L	100
<u>Total</u>	<u>2,300</u>
<u>Grand Total</u>	<u>3,900</u>

Douglas-fir tussock moth, *Orgyia pseudotsugata*

There was no noticeable defoliation by tussock moth larvae in the Vancouver Forest Region in 1978. No larvae were taken in beating samples.

Five traps made from 2.3l litre milk cartons and each baited with a pheromone to attract adult males, were set out at each <sup>of</sup> 4 locations. Moths were caught at 3 locations (Table 15).



Table 15. Number of male Douglas-fir tussock moth collected in pheromone traps, Vancouver Mainland Section, 1978.

Location	No. adults trapped	
	Totals	Average
Clearbrook	5	1
Haig Hwy (Hope)	0	0
Alexandria (Fraser Canyon)	8	1.6
Boston Bar (Fraser Canyon)	1	.2

Spruce beetle, Dendroctonus rufipennis

Only 2 infested Engelmann spruce trees were found between km 20-24, <sup>Mowhokam</sup> ~~Mowhokam~~ Creek mainline road. A number of previously attacked Engelmann spruce trees (prior to 1976) were found in this area. These surveys were carried out to assist M. Shrimpton P.F.R.C. to locate currently infested trees.

Western cedar borer, Trachykele blondeli

Western red cedar poles at Bell Pole companies yard near Haney, were damaged by western cedar borers. These poles were cut in the Harrison Lake and Sechelt Peninsula areas.

The most reliable external evidence that the poles had been damaged by the cedar borer was the galleries on the knots after the poles has been peeled, and also the galleries on the top and butt of the poles. Approximately 100 poles had to be culled at this <sup>yard</sup> ~~year~~ due to the borer damage and were sold as sawlogs. Borer damage was also reported from the Duncan area in cedar sawlogs which is causing concern with the sawmill operators.

Birch leaf miner, Lyonetia sp.

Heavy browning of western white birch foliage caused by birch leaf miners was again evident in many parts of the Fraser Valley and Lower Mainland. The heaviest infestations occurred in the Hope-Yale area and along the Deas Island Freeway. This is the fifth consecutive year that damage has occurred in these areas.

Balsam bark beetle, Dryocoetes - Ceratocystis complex

Alpine fir tree mortality was evident along Mowhokam and Ainslie creeks in the Fraser Canyon. This is the third year this damage has been noted. Most of the damage occurs in mixed stands of alpine fir, Engelmann spruce and lodgepole pine. Logging activity in the Mowhokam Creek area is removing some of the red-topped and currently-infested trees.

A lodgepole pine needle miner, ? Coleotechnites sp

Needle miner damage to immature lodgepole pine stands occurred near the north end of Chilliwack Lake. Approximately 60 ha of foliage discoloration was evident along a west facing hillside. On June 6 the miners were in the needles, in the pupal stage. No positive identification has been made on the needle miner causing this damage.

Gypsy moth, Porthetria dispar

The Plant Quarantine section of Agriculture Canada carried out a pheromone-trap survey in parts of the City of Vancouver which resulted in the capture of 5 male moths in 1 trap in the Kitsilano area. This is the first record of gypsy moth occurring in British Columbia. A subsequent egg survey in the fall in the Kitsilano area of Vancouver where the moths were trapped resulted in 30+ egg masses being found on 5 properties all located in or on the edges of two contiguous blocks bounded by York Street on the north, First Avenue on the south, Stephens Street on the west and Larch street on the east.

Although the survey was short and did not cover an extensive area, it was felt that the epicenter of the infestation had been found. Egg mass discoveries were confined to a relatively small area very near to the only trap in which moths were found.

For a more detailed report on the gypsy moth trap and egg survey carried out in the Vancouver area see memo to W.P. Campbell, A/Director, Plant Quarantine Division Regard Progress, Regarding Gypsy Moth in Vancouver October 1978 (Appendix 6).

Gypsy moth traps were set out at 10 locations by the Forest Insect and Disease Survey in the Fraser Valley singly at Harrison Lake, Cultus Lake, Kawkawa Lake, Hope and at Sumas. On Vancouver Island traps were set out at Goldstream Park, Humpback Campgrounds and Langford all in the Victoria area. All traps were on site from early July to the end of October. All traps showed negative results.

Fall webworm Hyphantria cunea

Tents made by this caterpillar were common throughout the Fraser Valley from Abbotsford to Yale on roadside deciduous trees and shrubs and on domestic fruit and shade trees. A few tents were noted in 1977 in these areas but in 1978 there was a significant increase in the number of tents.

On Vancouver Island fall webworm larvae were very scarce except near Cassidy Airport on black cottonwood and willow. A few webs noted on red alder on Galiano Island, Nanoose and Sprout Lake.

Balsam woolly aphid, Adelges piceae

A special balsam woolly aphid survey was carried out on Vancouver Island in the spring of 1978 and during the summer on the Vancouver Mainland to ascertain if the aphid had spread beyond the known infestation boundaries. No new distribution was found beyond the known boundaries. (See Appendix 7).

Silverspotted tiger moth, Halisidota argentata

The number of collections sent into the Pacific Forest Research Centre by homeowners and the British Columbia Forest Service from the Sechelt Peninsula in the early spring of 1978, indicated that this defoliator was quite common in the Sechelt-Gibsons Landing area. Subsequent surveys conducted in these areas during the summer did not reveal any noticeable defoliation to Douglas-fir.

Occasional colonies were observed on Southern Vancouver Island, during the early spring.

Cascara looper, Triphosa haesitata

The leaves of scattered cascara <sup>trees</sup> ~~trees~~ in the Port Renfrew - Fairy area were almost totally defoliated in May and June.

Striped alder sawfly, Hemichroa crocea

For the third consecutive year, alder sawflies severely defoliated red alder on Salt Spring Island from Fulford Harbour to Isabella Point. Moderate skeletonizing also occurred on all ages of alder in coastal areas from Mill Bay to Cherry Point and Cowichan Bay. The insect has been scarce since 1956. Extensive outbreaks were recorded between 1933 and 1956.

Alder flea beetles, Altica spp.

Alder flea beetles defoliated red alder trees along Comox Creek and at Blackjack Lake on Vancouver Island. In the Mainland section, alders were defoliated along the Chilliwack River and at the south end of Chilliwack Lake.

Balsam twig aphid, Mindarus abietinus

Severe twig aphid infestations occurred on understory grand fir trees on the Gulf Islands. Attacks were moderate along the east coast of Vancouver Island to Courtenay and on Hornby Island.

Pine butterfly, Neophasis menapia

Numerous adults were noted hovering around the crowns of mature Douglas-fir trees from Alberni to Parksville and especially in Cathedral Grove (MacMillan Park). Adults were common in the Greater Victoria and Gulf Islands area. No appreciable defoliation was observed. The last major outbreaks resulting in defoliation occurred in the Nimpkish Valley in 1965 and in Cathedral Grove from 1959 to 1961.

A conifer sawfly, Neodiprion sp.

In the fall, reports of heavily defoliated western hemlock and amabilis fir trees were received from northern Vancouver Island, namely Schoen Creek, Kelsey Bay and Cormorant and Pease Islands. During the summer, before heavy defoliation appeared, 3-tree beating samples made in these general areas contained from 200 to 400 larvae, at Schoen Lake, Haihte Lake, Holberg, Port Alice and from Reinhart Lake and Green Mountain on southern Vancouver Island.

Table 16. Other insects of current minor significance.

<u>Insect</u>	<u>Host(s)</u>	<u>Locality</u>	<u>Remarks</u>
<u>Adelges cooleyi</u> Spruce gall aphid	Douglas-fir Spruce, Sitka	widespread	Sucking insect. Common in seed orchard on Vancouver Island.
<u>Contarinia</u> spp. Needle Miners	Douglas-fir	Vancouver Island	Needle miner. Common in seed orchard on Vancouver Island.
<u>Ectropis crepuseularia</u> Saddleback looper	Hemlock, western cedar, wester red	Vancouver Mainland Sechelt Peninsula, Powell River	Defoliator. Larvae common in collections in low numbers.
<u>Lambdina f. lugubrosa</u> Western hemlock looper	Hemlock, western Douglas-fir, cedar wester red	Vancouver Mainland	Defoliator. 13% of collections positive from Hemlock with an average of 1.0 larvae per positive collection
<u>Pissodes strobi</u> Sitka spruce	spruce, Sitka	West Coast Vancouver Island	Terminal weevil, causing damage in natural and replanted areas.

Number of collections containing larvae  
1970 - 1978

Insect	District	Year								
		70	71	72	73	74	75	76	77	78
<u>Acleris</u>	VI	200+	135	200+	200+	30	5	4	1	6
<u>gloverana</u>	VM	90	35	100	80	20	8	3	1	0
<u>Choristoneura</u>	VI	8	8	10	20	5	5	10	13	10
<u>occidentalis</u>	VM	30	50	60	140	150+	150+	45	28	18
<u>Ectropis</u>	VI	11	1	4	12	9	2	5	0	3
<u>crepuscularia</u>	VM	12	8	13	32	5	22	0	7	5
<u>Lambdina F.</u>	VI	21	9	10	9	2	0	2	1	2
<u>lugubrosa</u>	VM	33	31	34	46	11	16	19	11	3
<u>Melanolophia</u>	VI	62	4	8	17	17	4	19	23	37
<u>imitata</u>	VM	18	7	23	70	34	57	15	47	23



1978 Annual Report

VANCOUVER FOREST REGION

Forest Disease Conditions

Currently Important Diseases

Dwarf mistletoe on western hemlock and Douglas-fir

Phellinus root rot

Drought damage

Discoloration of broadleaf maple foliage

Winter damage

Nursery pests, Vancouver Forest Region, 1978 (Appendix 10)

Tree Hazard (Appendix 11)

Hemlock dwarf mistletoe, Arcenthobium tsugense

Surveys were initiated in 1976 at Cowichan Lake in a juvenile-spaced dwarf mistletoe infected second growth western hemlock stand, to study the effects of spacing on mistletoe infections. Mistletoe plants and non-productive or dormant mistletoe swellings which were tagged for observation on the effects of spacing on shoot and seed production were again examined in October 1978. The following shows the results of these examinations:

	Sept. 1977	Oct. 1978	% change Sept 1977 - Oct. 1978
Avg. no. of shoots per swelling	7.43	9.77	+ 23.90%
Avg. swelling length (cm)	17.48	17.18*	- 1.75%
Avg. swelling diameter (cm)	1.79	1.83	+ 2.18%
Avg. length of longest shoot (cm)	.80	1.91	+ 58.11%
% of swellings re-activated	(35/44)79.5%	(35/43)81.4%	+ 2.30%

\* Discrepancy due to swelling which was on broken off branch. This swelling was 31.0 cm long, if it was added in, the average swelling length would be 17.49 cm.

In summary, one year after spacing, 80% of the tagged, older and apparently "dormant" swellings had produced an average of 7.4 aerial shoots, and the number of shoots on reproductive swellings had doubled. The activity of the infections continued unchanged after 2 years, the average number of shoots increased to 9.8, and the average length of the longest shoot more than doubled (See Appendix 8).

A hemlock dwarf mistletoe area has been tentatively located in the Chilliwack River area at the nursery reserve where juvenile spacing is planned for the spring of 1979. The Damage Appraisal Group plan on doing a preliminary survey before spacing to study the effects of dwarf mistletoe infections before and after spraying. An area also has been set aside where no spacing will be done as a control plot (See Appendix 8).

Douglas-fir mistletoe Arcenthabium douglasii

Douglas-fir mistletoe was found infecting a single Douglas-fir tree at Slesse Creek in the Chilliwack River Valley. This is the first record of Douglas-fir mistletoe occurring in coastal British Columbia.

Western globose gall rust, Endocronartium harknessii

A continuing and common problem throughout much of the range of shore pine in the Vancouver Forest Region. Infections were particularly extensive at the north end of Chilliwack Lake and at Long Beach on Vancouver Island, causing branch flagging of mature trees and mortality of some saplings.

Phellinus root rot, Phellinus weirii

Root rot surveys were carried out by the British <sup>Columbia</sup> ~~Columbian~~ Forest Service forestry crews at Ring Creek in the Squamish Ranger District. The survey was conducted in an immature Douglas-fir stand using a survey method devised by G. Wallis.

The affected stand is 90% Douglas-fir, 50-70 years old covering an area of 120 ha. The areas of infection centre totalled approximately 10 ha over about 30 sites. For a more detailed report and map on this survey carried out at Ring Creek see A. Renwick Phellinus Root-Rot Report September 5, 1978 (Appendix 9).

White pine blister rust, Cronartium ribicola

Blister rust infections continue to result in top killing of mature western white pine trees near the headwaters of the Skagit River, along Silverhope Creek and in the Blackwater Creek - Birkenhead Lake areas. Mortality of white pine saplings occurred at scattered points along the westcoast of Vancouver Island.

Drought damage

Douglas-fir trees in the Pemberton, Boston Bar and Chilliwack River area were showing symptoms of drought damage. Small groups of 1 to 5 trees 3-11 m in height were dying back from 1 to 6 m from the top and a few trees had been killed. This is the second year damage has been noted in these areas.

In the Squamish River Valley at Shovelnose Creek approximately 52 ha of Douglas-fir 50-80 years old have symptoms of drought damage with top dieback and sparse foliage. Over 100 trees have been attacked by Douglas-fir beetle.

On Vancouver Island drought damage was noted in the Ash River area near Port Alberni, Sayward Forest near Campbell River, Nanaimo Lakes, and in the Nimpkish Valley in immature Douglas-fir stands. The effected trees occur in small groups of 1 to 5 trees scattered throughout the stands with dieback from 1 to 5 m and a few trees completely killed.

Large areas of shore pine, western hemlock, western red cedar and Douglas-fir appeared damaged from drought on Cortes and surrounding islands in a swath continuing onto Vancouver Island west of Campbell River. These observations were made during aerial surveys.

#### Discoloration of broadleaf maple foliage

The foliage of broadleaf maple trees was discolored throughout many parts of the coastal areas of the Forest Region. This condition has persisted for the past 4 years but did not appear as heavy in 1978. No causal agent has been found to date. The presence of numerous leaf hoppers and aphids was noted at most localities examined. See 1977 File Report Vancouver Forest Region (Appendix 14).

#### Winter damage on coniferous trees

The foliage of Douglas-fir and western red cedar trees suffered winter damage (to their foliage) in the Fraser Valley from Yale to Abbotsford. Most of the damage to the foliage occurs on the north and east side of the trees causing red flagging. Reports of a sudden temperature drop in December and a strong outflow wind from the interior B.C. lasted for several days. Prior to this temperature drop, the weather was relatively mild and possibly the trees had not harden off for the winter.