Forest insect and disease conditions in Newfoundland and Labrador in 1991

A.G. Raske, W.J. Sutton, E.C. Banfield, D.M. Stone, D.S. O'Brien, K.E. Pardy and G.C. Carew

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Cover Photo: European pine sawfly larvae (*Neodiprion sertifer*) feeding on Scots pine.

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ABSTRACT

This report summarizes forest pest conditions in Newfoundland and Labrador in 1991 and forecasts infestations of major defoliators for 1992. Summaries were compiled from information collected by Forest Insect and Disease Survey staff in 12 districts of the Province.

The total infestation of the **hemlock looper** decreased to 4 870 ha in 1991, but moderate and severe defoliation increased to 4 160 ha. The infestation is forecast to cause 26 500 ha of defoliation in 1992 including 5 700 ha in the moderate and severe class.

The size of the **spruce budworm** infestation increased in 1991 to 2 300 ha of moderate and severe defoliation, and an additional 500 ha was classed as light. However, the severity of defoliation within the infestation increased and many young stands were nearly 100% defoliated. The number of male moths caught in pheromone traps throughout the Province increased to 6 089 in 1991. About 17 100 ha of moderate and severe defoliation is forecast for 1992, and 78 900 ha of light defoliation. Of special concern is the general population rise, within endemic populations, in many localities in western Newfoundland.

Total area of defoliation, caused by the **blackheaded budworm** decreased to 16 400 ha in 1991, including 12 400 ha in the moderate and severe class. About 13 800 ha are forecast to be moderately and severely defoliated in 1992 and the total infestation could spread to 36 100 ha.

RÉSUMÉ

Le rapport résume la situation des insectes ravageurs des forêts à Terre-Neuve et au Labrador en 1991 et présente les prévisions d'infestation par les principaux défoliateurs pour 1992. Des résumés ont été établis à partir des données recueillies dans 12 districts de la province par le personnel du Relevé des insectes et des maladies des arbres.

Les secteurs infestés par **l'arpenteuse de la pruche** ont diminué pour atteindre 4 870 ha en 1991, mais les régions modérément et gravement défoliées ont augmenté à 4 160 ha. En 1992, l'infestation par ce ravageur devrait entraîner la défoliation de 26 500 ha, y compris 5 700 ha modérément et gravement défoliés.

La défoliation par la **tordeuse des bourgeons de l'épinette** a augmenté en 1991 avec 2 300 ha modérément et gravement défoliés, et 500 ha légèrement défoliés. Cependant, la gravité de la défoliation dans les secteurs infestés a augmenté et de nombreux jeunes peuplements ont été défoliés à près de 100%. Le nombre de papillons mâles capturés dans des pièges à phéromones dans la province s'est accru pour atteindre 6 089 en 1991. Quelque 17 100 ha devraient être modérément et gravement défoliés en 1992, et 78 900 légèrement défoliés. L'augmentation générale des populations, au sein des populations naturelles, est une source d'inquiétude dans plusieurs localités de l'ouest de Terre-Neuve.

La superficie totale de la défoliation causée par la **tordeuse à tête noire** a diminué, passant à 16 400 ha en 1991, y compris 12 400 ha modérément et gravement défoliés. Environ 13 800 ha devraient être modérément et gravement défoliés en 1992 et l'infestation pourrait se propager à 36 100 ha en tout.

Areas of defoliation by the **balsam fir sawfly** increased to 11 700 ha of balsam fir and included 2 000 ha of light defoliation.

In addition to the four major forest pests above, a total of 13 other insect species and 11 diseases caused minor forest damage.

Moose caused considerable damage to thinned stands of balsam fir and were of concern to forest managers.

Winter drying and frost damage were the most severe and widespread damage of abiotic origin.

Les superficies défoliées par le **diprion du sapin** ont augmenté, affectant 11 700 ha de sapins baumiers, dont 2 000 légèrement défoliés.

En plus des quatres principaux ravageurs susmentionnés, 13 autres espèces d'insectes et 11 maladies ont causé des dégâts mineurs aux forêts.

Les orignaux ont considérablement ravagé les peuplements éclaircis de sapins baumiers et ont causé beaucoup de soucis aux aménagistes.

De tous les dommages d'origine abiotique, les plus sérieux sont attribuables à la dessiccation hivernale et au verglas.

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ACKNOWLEDGEMENTS

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FOREST INSECT AND DISEASE CONDITIONS IN NEWFOUNDLAND AND LABRADOR IN 1991

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INTRODUCTION

One major aim of the Forest Insect and Disease Survey is to summarize the factors that decrease the health of the forests of Newfoundland and report these changes to clients at the regional and national level. Information on forest health, in the form of describing pest populations and other conditions, are disseminated through seasonal highlights, special reports, Information Reports and the Annual Report of the Forest Insect and Disease Survey.

This report provides forest managers with information of pest conditions in Newfoundland, Forest Statistics with regional information for national roll-ups, and forms a part of the historical record of pest conditions for Newfoundland. Insects, diseases, and conditions that were widespread in 1991, or caused considerable concern, are discussed in detail in the text, whereas those of lesser importance are added in tabular form. Pertinent data of special surveys are added in appendices.

The Forest Insect and Disease Survey monitored the abundance of forest pests and their damage in forested areas throughout the Island and Labrador in 1991. The extent of major pest infestations were mapped, population levels sampled and the distribution of damage surveyed to provide their status in 1991. A forecast of infestations of major defoliators is provided for 1992. Survey personnel collected 533 insect and 73 disease samples in 12 ranger districts (Fig. 1) and 19 Forest Management Units (Fig. 2) in Newfoundland and Labrador.

Special collections of blackheaded budworm eggs were sent to Bob McCron, FPMI; spruce bud moth adults to Allan Carroll, UNB; spruce budworm and hemlock looper pupae to Dave Langor, Northwest Region and diseased hemlock looper larvae to Dr. R. Nolan, MUN.

A total of 199 hours were flown in fixed-wing aircraft and helicopters to sample inaccessible areas, to map insect defoliation and damage, and to sample egg populations to forecast infestations of major pest defoliators. ARNEWS plots and permanent sample plots were sampled and measured for damage and for annual increment. Soil samples were collected from all ARNEWS plots for chemical analyses.

Quantative estimates of pest conditions were obtained whenever possible, but for various reasons some information can only be reported in qualitative terms. In this report, classes of population levels or damage express the following ranges:

Trace	1% to 5%
Light	6% to 25%
Moderate	26% to 75%
Severe	76% to 100%
Extreme	100% plus additional damage

Very cool temperatures and above average precipitation persisted throughout the Island and in Labrador for all of spring and summer, retarding insect development by about one month later than average. Temperatures in Labrador moderated during August but remained cool on the Island. On two occasions heavy rains caused flooding in urban areas on the Avalon Peninsula. Near normal weather conditions prevailed during the fall.

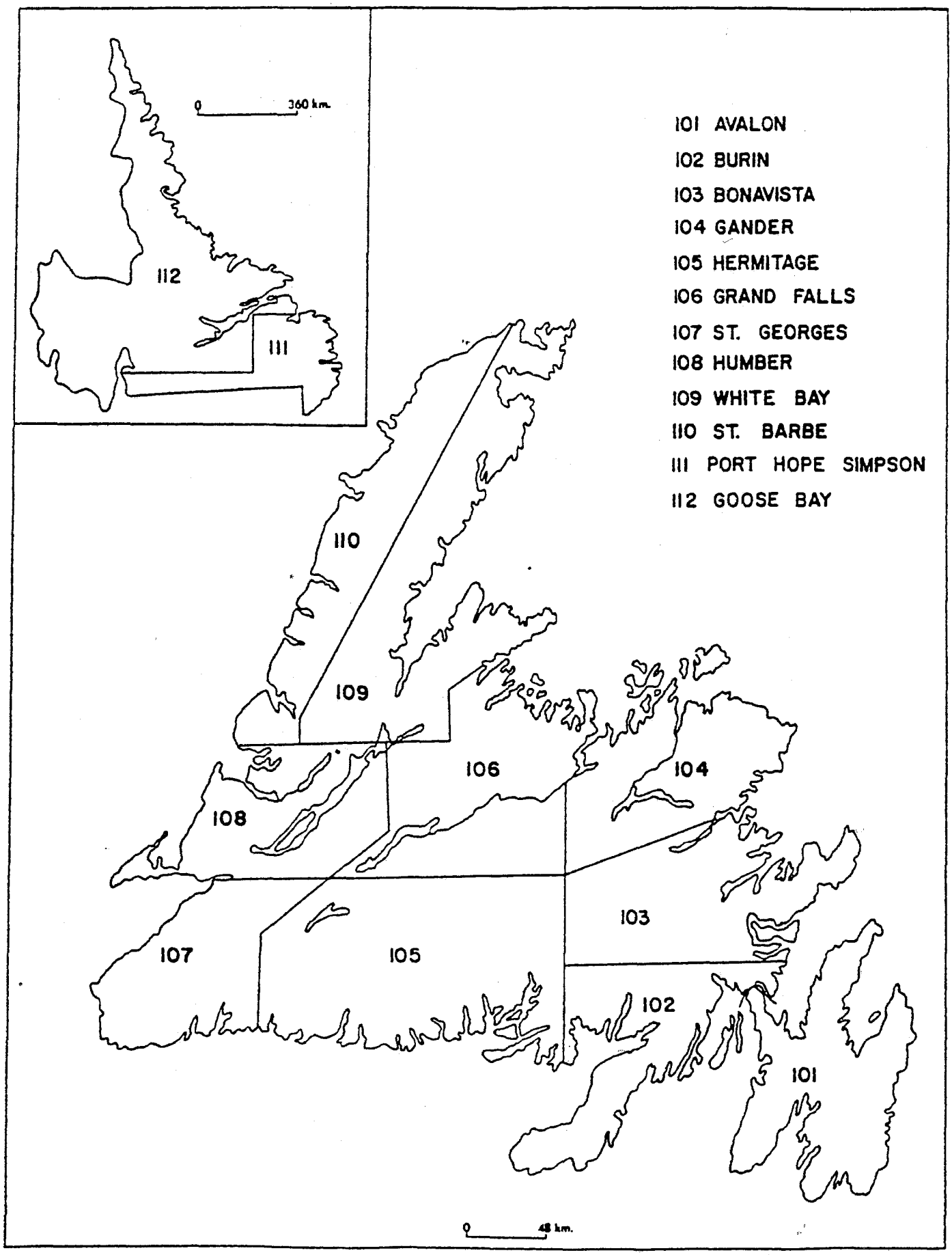

Figure 1. Forest Insect and Disease Survey Districts.

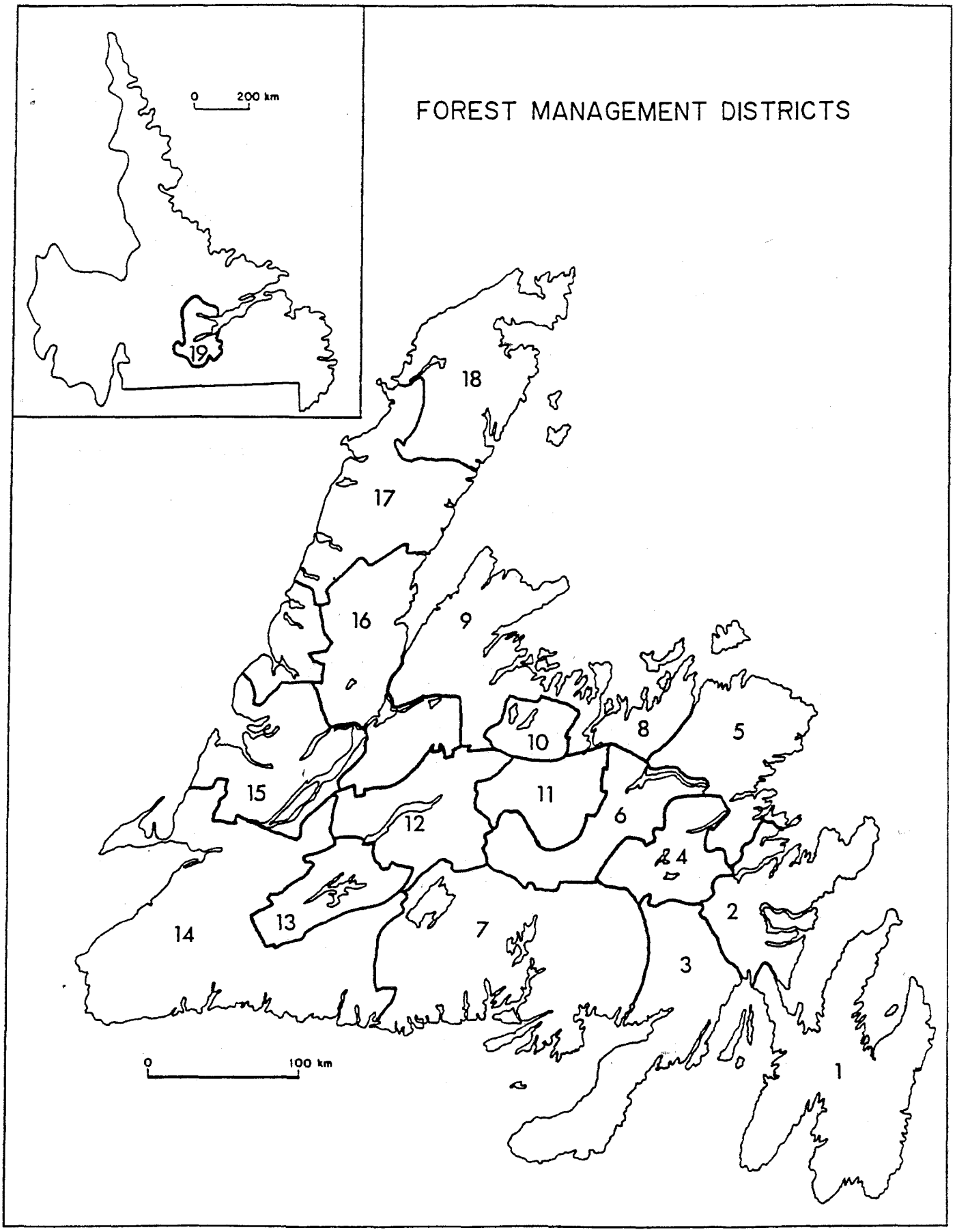

Figure 2. Newfoundland Forest Management Districts.

PEST STATUS

INSECTS

Hemlock Looper
Lambdina fiscellaria

The total area of infestations of all regions declined from 16 000 ha in 1990 to 4 870 ha in 1991. However, the areas of moderate and severe defoliation within the infestations increased from 2 620 ha in 1990 to 4 160 ha in 1991; about half of this area, 2 200 ha, occurred in eastern Newfoundland (Table 1, Fig. 3). Generally within severely infested areas the density of looper populations was lower in 1991.

The infestation on the Northern Peninsula continued to decrease with scattered areas of severe defoliation recorded north of the 1990 outbreak. The area of infestation in eastern Newfoundland increased in 1991 to 2 910 ha, and defoliation was recorded in previously infested areas and also in newly recorded areas on the Bonavista Peninsula, near Sunnyside and between Long Harbour and Argentia Road on the Avalon Peninsula. Within the total area of infestation 2 635 ha of productive forests were moderately and severely defoliated (Table 1, Fig. 3).

There was no experimental or operational control program against the hemlock looper in 1991.

Larvae were collected for parasite rearing from the Avalon, Burin and Northern Peninsulas. Parasitism was only about 2% in all three locations but diseases killed 60% to 78% of the larvae. (This includes a small percentage that died of unknown causes.) The high proportion of diseased larvae may have been related to the cool damp weather.

Table 1. Areas (ha) of defoliation* and gross merchantable volume (m^3) caused by the hemlock looper in productive forests and areas of total infestation in Newfoundland in 1991.

Forest Mgmt. Unit	Productive Forest**								Total Infestation (ha)			
	Light		Moderate		Severe		Total					
	Area	Vol. (x 000)	Area	Vol. (x 000)	Area	Vol (x 000)	Area	Vol (x 000)	Light	Mod.	Sev.	Total
1	400	23	100	4	600	39	1100	66	700	200	1800	2700
2	7	0.7	150	12	40	3	197	15.7	10	150	50	210
17	-	-	-	-	15	0.7	15	0.7	-	15	15	30
18	-	-	30	2	1700	154	1730	156	-	30	1900	1930
Totals	407	23.7	280	18	2355	196.7	3042	238.4	710	395	3765	4870

*Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% - 100%

**Provided by the Forest Management Division, Dept. of Forestry & Agriculture.

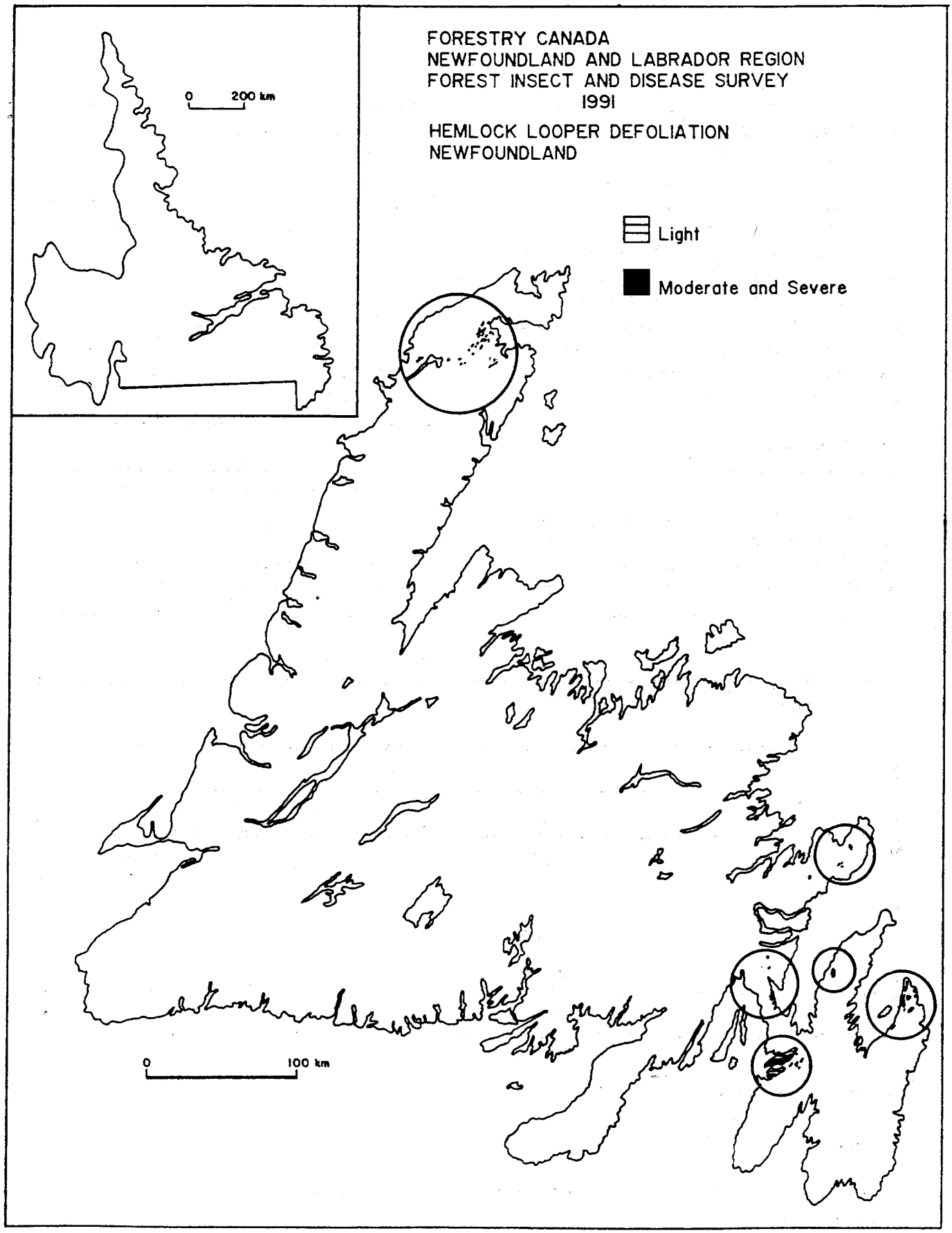

Figure 3. Areas of defoliation caused by the hemlock looper in Newfoundland in 1991.

Overwintering egg numbers were sampled at 311 sample points from mid- to late October to forecast subsequent infestations. A few high egg populations were recorded in the Hawkes Bay area, near Mount Margaret, and moderate defoliation is expected near Northeast Arm (Roddickton), and in eastern Newfoundland near Sunnyside and on the Avalon Peninsula. The old infestation near Main Brook is expected to decline in 1992. Moderate to severe defoliation is expected to occur on 5 700 ha overall and an additional 20 800 ha is forecast to be lightly defoliated (Table 2, Fig. 4).

Spruce Budworm
Choristoneura fumiferana

High populations of the spruce budworm in 1991 occurred only in the Codroy Valley on a total of 2 770 ha; an increase from the 2 200 ha infested in 1990. However, the area of moderate and severe defoliation increased considerably to 2 250 ha in 1991 from the 1 300 ha recorded in 1990 (Table 3, Fig. 5). The area of light defoliation decreased from 900 ha in 1990 to 520 in 1991. However, the intensity of severe defoliation within the outbreak increased greatly in 1991 and many young stands within the outbreak were nearly 100% defoliated.

Within the infestation the areas of productive forests affected totalled 2 000 ha of moderate and severe defoliation and 300 ha of light defoliation with 86 000 m^3 of timber affected in all three defoliation categories.

There was no experimental or operational control program against the spruce budworm in 1991.

Data on mortality factors were collected from the infestation in western Newfoundland. Only 3% of the larvae (n = 209) collected in

Table 2. Areas (ha) of defoliation by the hemlock looper forecast in forested areas of Newfoundland for 1992.

Forest Management Unit	Defoliation Class*		
	Light**	Moderate & Severe**	Total
1	7 600	1 800	9 400
2	-	700	700
17	7 000	2 300	9 300
18	6 200	900	7 100
Total	20 800	5 700	26 500

*Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% - 100%

**Light = average egg densities of 1-3 eggs/branch; Moderate and Severe = average egg densities of 4 or more eggs/branch.

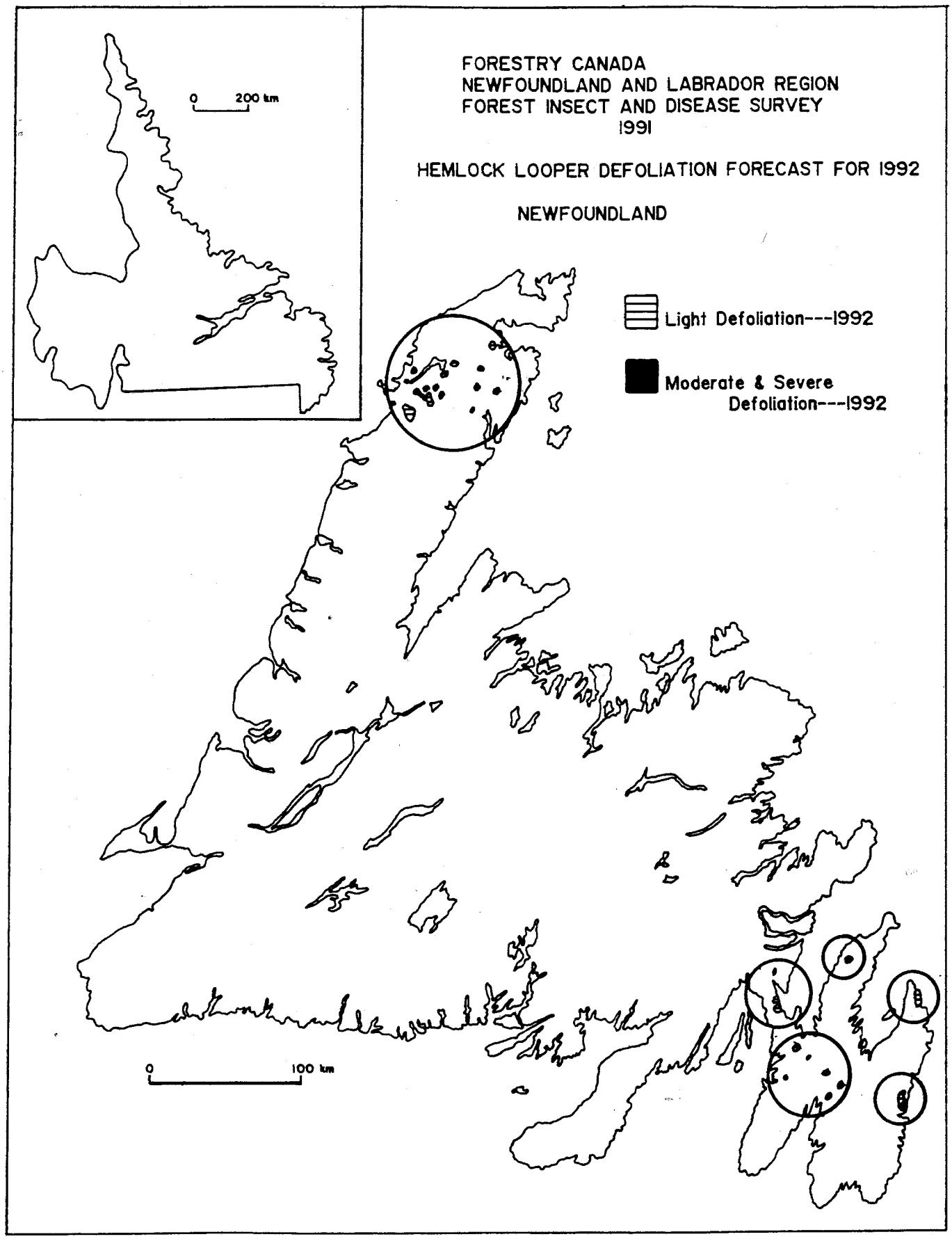

Figure 4. Areas of defoliation by the hemlock looper forecast in forested areas of Newfoundland in 1992.

Table 3. Areas (ha) of defoliation caused by the spruce budworm in forested areas of Newfoundland in 1991.

Forest Management Unit	Defoliation Class*			
	Light	Moderate	Severe	Total
14	520	300	1950	2770

*Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% - 100%

the infestation were parasitized but about 61% were killed by diseases. (This includes a small proportion of larvae that died of unknown causes.) The high proportion of larvae killed by diseases was probably related to the cool, damp weather which favoured the diseases and also delayed larval development.

Pheromone traps were placed at 50 permanent sample locations throughout the Island (Appendix I). The total number of moths increased about four-fold from 1 452 in 1990 to 6 089 in 1991. The highest numbers of males trapped were along the west coast of the Island. The trap location with the highest numbers was Codroy Pond with 1 773 moths within the outbreak area. The next highest trap catches were recorded at three coastal locations: near Corner Brook (788), Campbell Creek (651) and Sally's Cove (538). Trap catches at three other western locations were above 100 moths and these were inland by 8 to 30 km. Most of these moths were trapped two to three weeks prior to local emergence and were transported to Newfoundland by warm air masses from the Maritime Provinces. Traps at 21 central Newfoundland locations averaged 38 moths per trap location (range 0 to 108), compared to an average of near zero moths trapped in 1990. Most of these moths were also trapped before local emergence. Trap catches in eastern Newfoundland, including the Avalon Peninsula, averaged 27 moths in 1991 at eight locations, compared to an average of eight moths in 1990. More than two-thirds of these moths were trapped before local emergence and were immigrants from the Maritime Provinces. The ratio of males to females of immigrated moths to Newfoundland is not known.

Overwintering populations were sampled at 496 locations in conjunction with the hemlock looper and blackheaded budworm egg sampling from mid- to late October. Moderate and severe defoliation is forecast to occur on 17 100 ha with most of these areas of damage concentrated near Codroy Pond in MU 14 (Table 4, Fig. 6). Other small areas expected to receive this level of damage occur on the Avalon and Bonavista Peninsulas, near Baie Verte and near Ten Mile Lake. Small areas of light defoliation can be expected in many parts of the Island.

The general rise of low population levels is reflected by the decreasing proportion of sample points with zero overwintering larvae. In 1988 this was 70%, 66% in 1989, and 43% in 1990. The percent of zero larvae/sample increased slightly in 1991 to 54% (Fig. 7). The increase was caused by the increase in samples (from 37 to 133) in central Newfoundland where budworm populations are not as high as in the western region and therefore a higher proportion of samples had zero counts. Without the additional sample points the percent of zero counts in 1991 was 39%; a decrease of 4% from 1990.

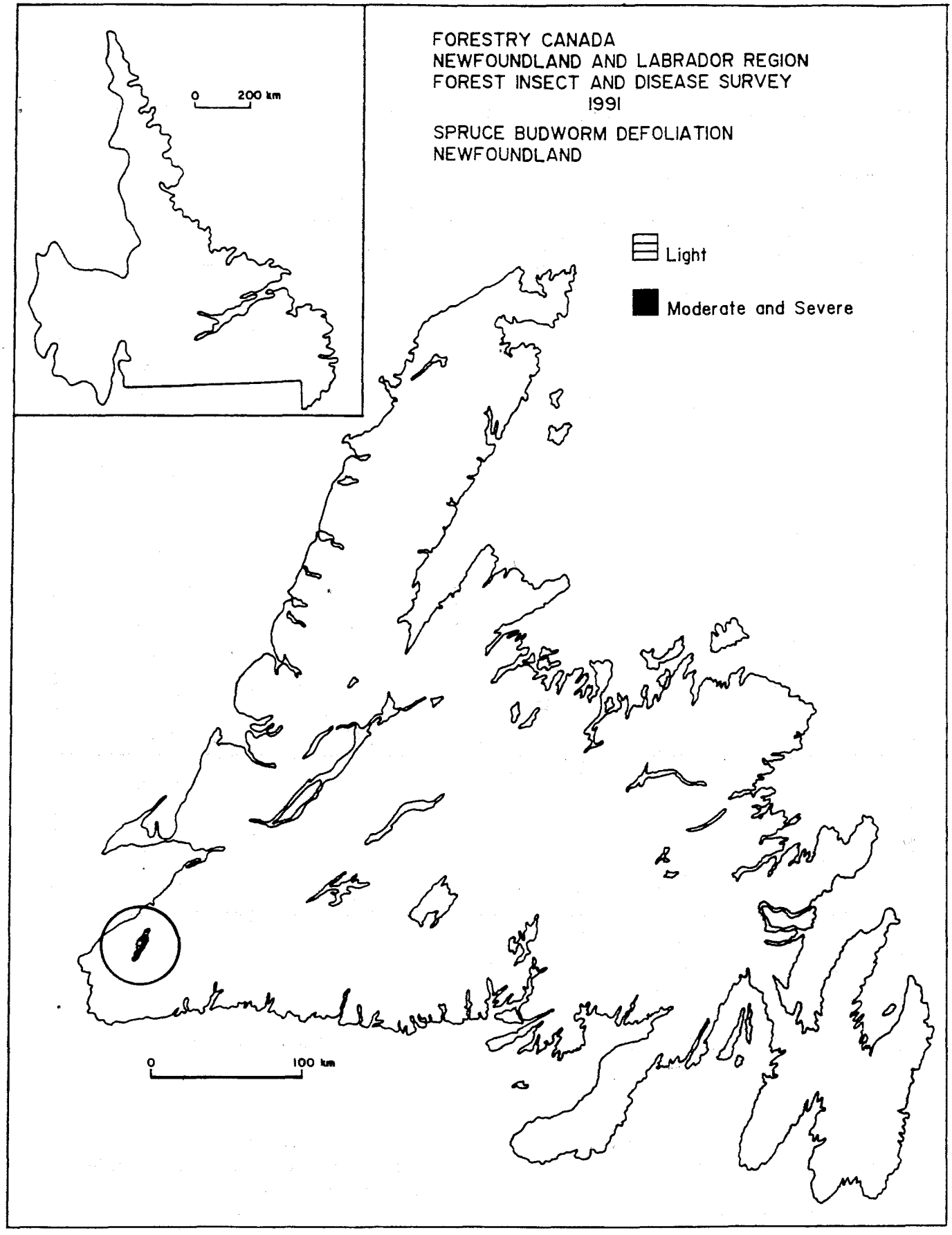

Figure 5. Areas of defoliation caused by the spruce budworm in Newfoundland in 1991.

Table 4. Areas (ha) of defoliation by the spruce budworm forecast in forested areas of Newfoundland for 1992.

Forest Management Unit	Defoliation Class*		
	Light**	Moderate & Severe**	Total
1	1 800	600	2 400
2	1 200	600	1 800
4	600	-	600
5	600	-	600
7	1 800	-	1 800
9	7 400	1 000	8 400
11	1 200	-	1 200
13	600	-	600
14	32 900	13 300	46 200
15	3 000	-	3 000
16	800	-	800
17	12 200	-	12 200
18	6 600	1 000	7 600
Total	70 700	16 500	87 200
GMNP	7 000	-	7 000
TMNP	1 200	600	1 800
Grand Total	78 900	17 000	96 000

*Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% - 100%

**Light = ≥ 108 larvae/10 m^2 foliage; Moderate and Severe = ≥ 109 larvae/10 m^2 foliage.
counts in 1991 was 39%; a decrease of 4% from 1990.

The outbreak near Codroy Pond in 1991 did not appear to increase much beyond the 1990 boundaries, indicating that the moths emigrating from that outbreak dispersed widely before ovipositing their remaining complement of eggs.

The large influx of male moths throughout the Island from mainland Canada, as indicated by the large numbers trapped in July (before local emergence), may not have been accompanied by large numbers of females

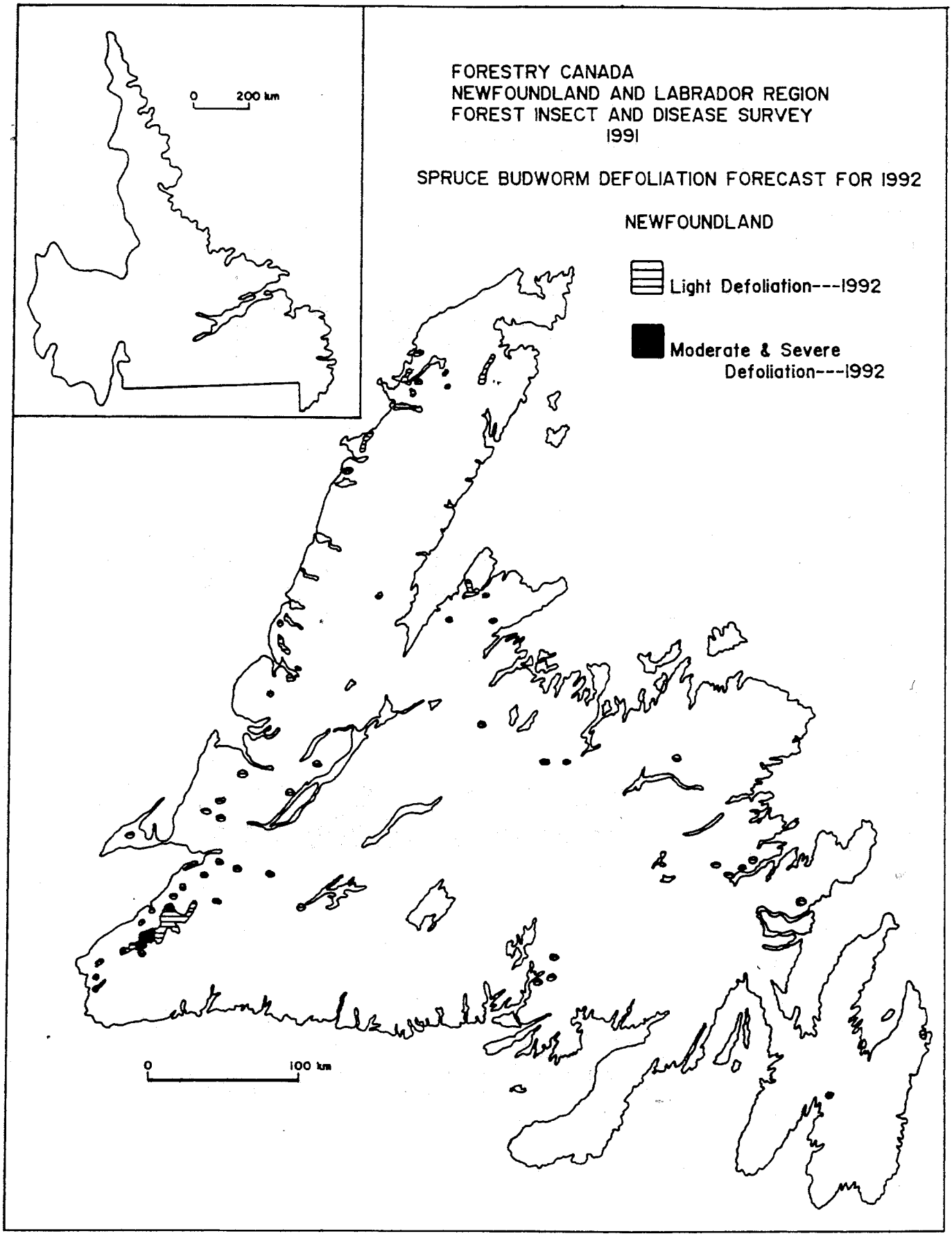

Figure 6. Areas of defoliation by the spruce budworm forecast in forested areas of Newfoundland for 1992.

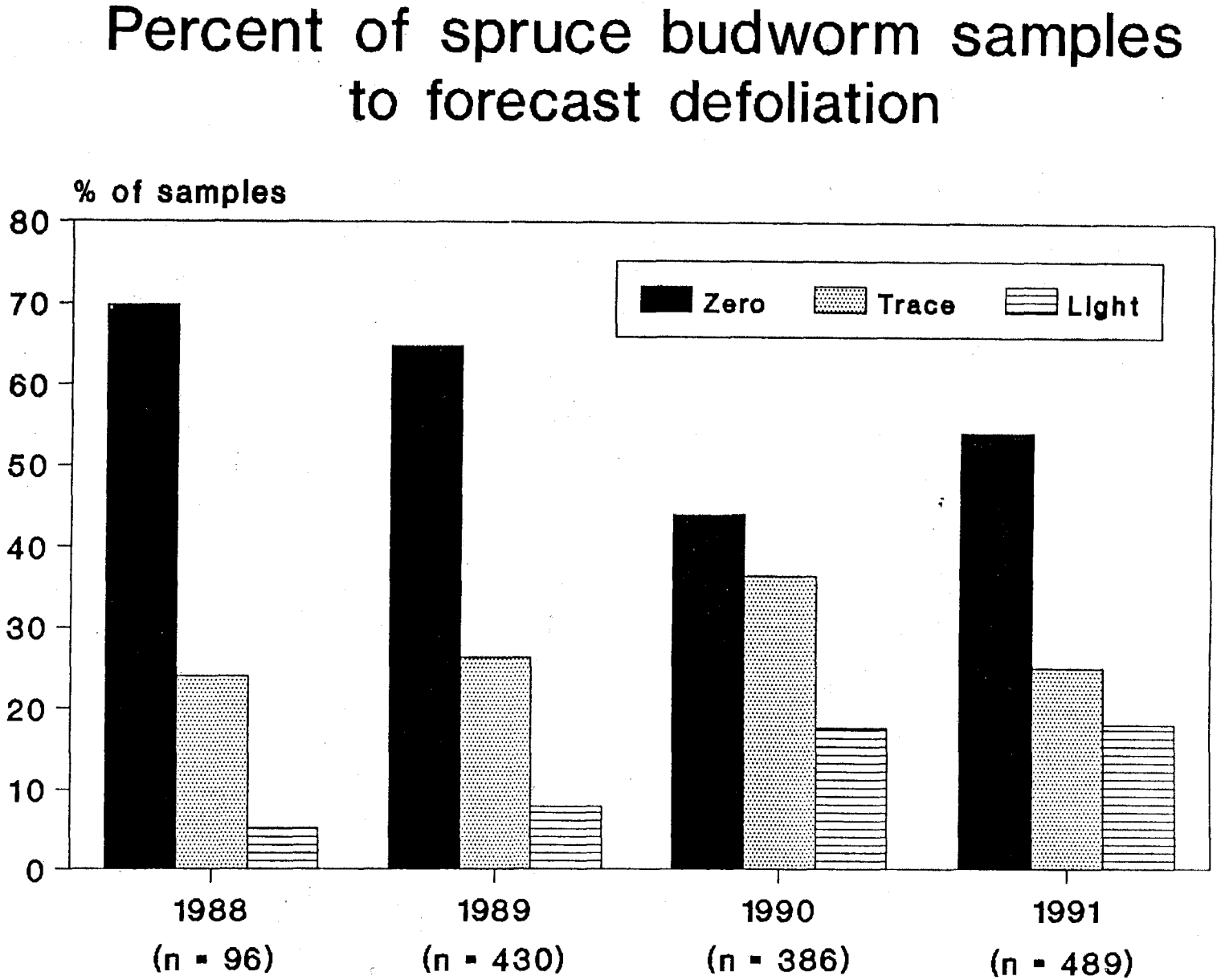

Figure 7. Percent of spruce budworm samples that forecast defoliation of Nil, Trace and Light from 1988 to 1991 in Newfoundland.

because a corresponding large increase in overwintering larvae did not occur in October.

Blackheaded Budworm
Acleris variana

The present outbreak of the blackheaded budworm on the Northern Peninsula has continued in the same general area since 1987, extending across the Peninsula from St. Barbe to Roddickton. Three new infestations were found this year at East River, Main River and White's River; all on the Northern Peninsula (Fig. 8). Scattered areas with high populations were also discovered on the Avalon Peninsula, but these did not cause significant defoliation.

Moderate and severe defoliation in 1991 occurred mainly in overmature stands on 12 400 ha plus light defoliation on an additional 4 000 ha (Table 5, Fig. 8). The corresponding areas in 1990 were 7 450 ha of moderate and severe defoliation and 14 300 ha of light. For the first time part of the 1991 infestation occurred in pre-commercially thinned stands. Within the infestation the area of productive forests infested was 8 600 ha of moderate and severe defoliation and 2 800 ha of light (Table 5).

There was no experimental or operational control program against the blackheaded budworm in 1991.

Larval populations from the Northern and Avalon Peninsulas were sampled in 1991 to assess the biological mortality factors. On the Northern Peninsula 23% of the larvae were parasitized by insects as compared to 14% in 1990 and about 48% were killed by diseases as compared to 7% in 1990. About 33% of the larvae sampled on the Avalon Peninsula were parasitized and 31% were infected with disease organisms. The proportion of larval mortality by diseases was unusually high.

Overwintering eggs were sampled from 154 sample points from mid- to late October.

Table 5. Areas (ha) of defoliation* and gross merchantable volume (m^3) caused by the blackheaded budworm in productive forests and areas of total infestation in Newfoundland in 1991.

Forest Mgmt. Unit	Productive Forest**								Total Infestation (ha)			
	Light		Moderate		Severe		Total					
	Area	Vol. (x 000)	Area	Vol. (x 000)	Area	Vol (x 000)	Area	Vol (x 000)	Light	Mod.	Sev.	Total
17	2100	141	900	82	5100	537	8100	760	3300	1500	8100	12900
18	700	24	1500	121	1100	71	3300	216	700	1700	1100	3500
Totals	2800	165	2400	203	6200	608	11400	976	4000	3200	9200	16400

*Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% - 100%

**Provided by the Forest Management Division, Dept. of Forestry & Agriculture.

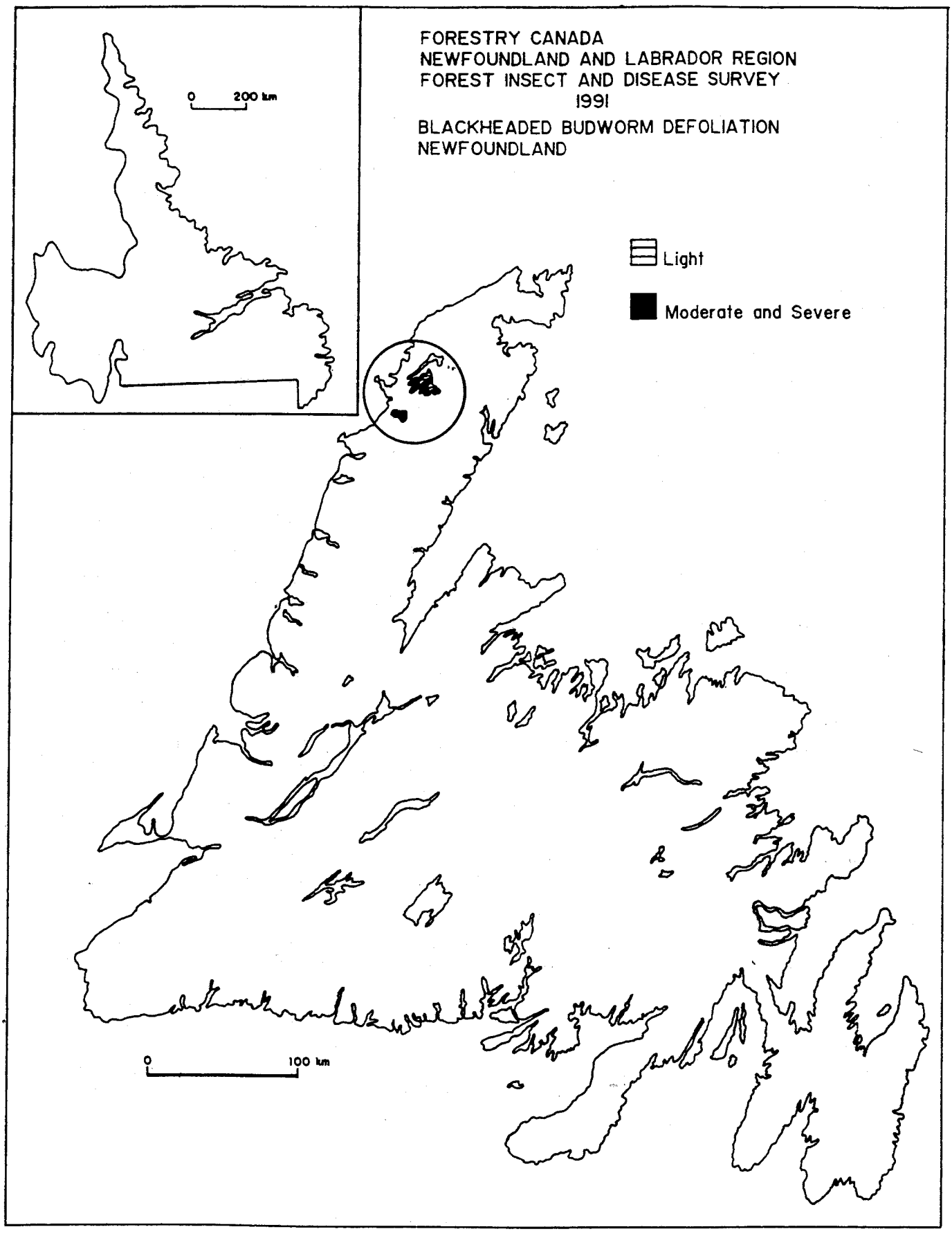

Figure 8. Areas of defoliation caused by the blackheaded budworm in Newfoundland in 1991.

Moderate and severe defoliation are forecast to occur on 13 800 ha with an additional 22 300 ha of light defoliation (Table 6, Fig. 9). Defoliation is expected to occur on the Northern Peninsula and a few areas on the Bonavista and Avalon Peninsulas.

Balsam Fir Sawfly
Neodiprion abietis

In 1991 severe defoliation by this forest pest was recorded throughout the Bay d'Espoir area. The infestation increased in area from 6 800 ha in 1990 to 10 900 ha in 1991, and 9 000 ha were classed moderate and severe. Much of the infestation and severe defoliation encompassed pre-commercially thinned stands. In addition, two populations on the west coast of the Island reached outbreak levels and caused defoliation of fir stands on 800 ha, of which 700 ha were classed severe. The area of infestation in productive forests was 8 400 ha, of which 6 900 ha were classed moderate and severe (Table 7, Fig. 10).

A viral disease caused a collapse of larval populations in a large area of the outbreak in the Bay d'Espoir area after feeding was mostly completed.

Egg samples to forecast populations were collected for the first time for this insect in fall of 1991 at 36 locations. Eggs were counted on one complete branch per tree from 5 trees per sampling point. Decision lines for expected defoliation categories were as follows for

Table 6. Areas (ha) of defoliation by the blackheaded budworm forecast in forested areas of Newfoundland for 1992.

Forest Management Unit	Defoliation Class*		
	Light**	Moderate & Severe**	Total
1	600	600	1 200
2	1 500	-	1 500
16	1 600	2 200	3 800
17	5 700	8 700	14 400
18	12 900	2 300	15 200
Total	22 300	13 800	36 100

*Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% - 100%

**Light = 50-400 eggs/10 m^2 foliage; Moderate and Severe = ≥ 401 eggs/10 m^2 foliage.

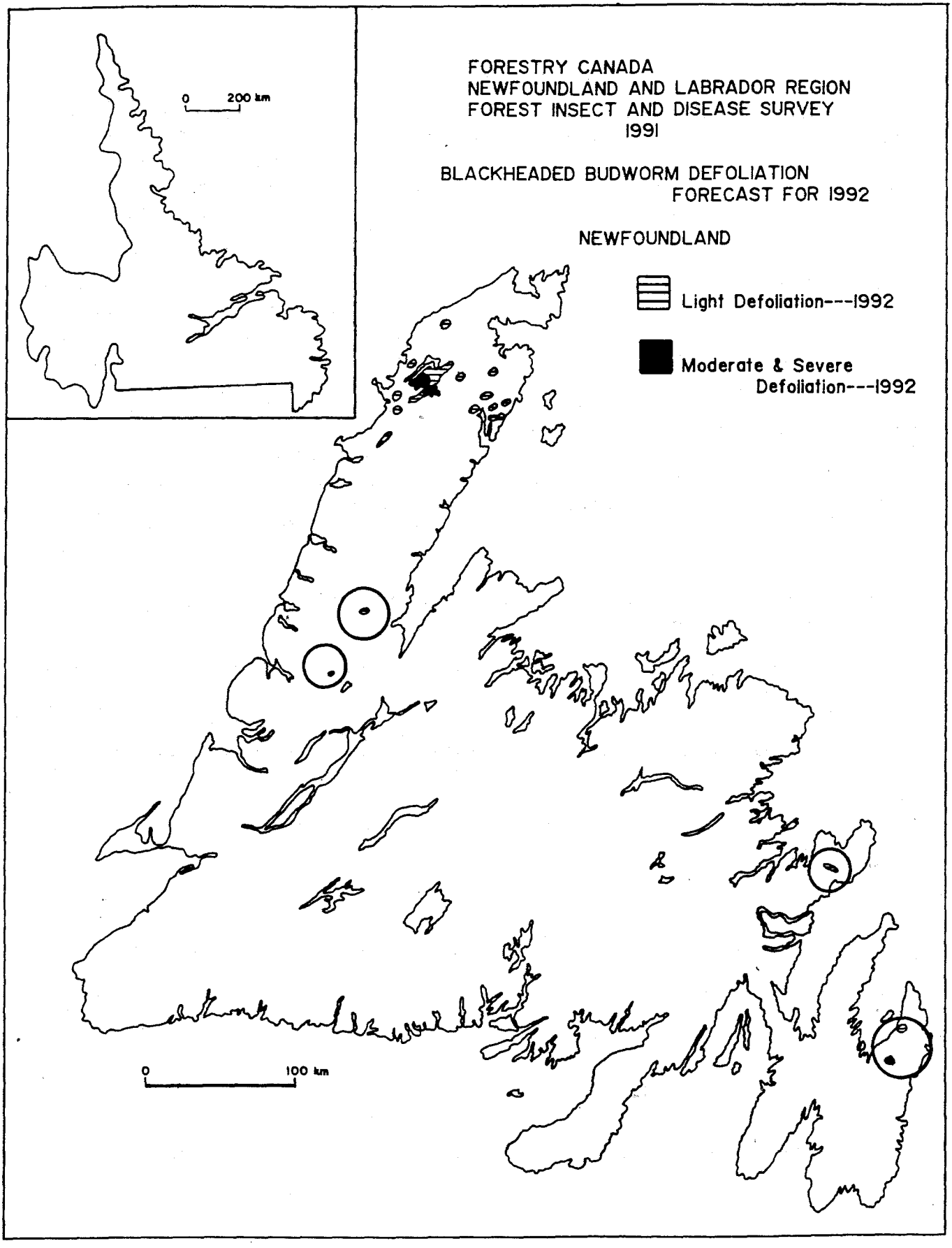

Figure 9. Areas of defoliation by the blackheaded budworm forecast in forested areas of Newfoundland for 1992.

Table 7. Areas (ha) of defoliation* and gross merchantable volume (m^3) caused by the balsam fir sawfly in productive forests and areas of total infestation in Newfoundland in 1991.

Forest Mgmt. Unit	Productive Forest**								Total Infestation (ha)			
	Light		Moderate		Severe		Total					
	Area	Vol. (x 000)	Area	Vol. (x 000)	Area	Vol (x 000)	Area	Vol (x 000)	Light	Mod.	Sev.	Total
7	1400	60	1500	82	4700	248	7600	390	1900	2200	6800	10900
14	100	2	-	-	700	14	800	16	100	-	700	800
Totals	1500	62	1500	82	5400	262	8400	406	2000	2200	7500	11700

*Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% - 100%

**Provided by the Forest Management Division, Dept. of Forestry & Agriculture.

average number of egg/branch:

5 - 20 = light
21 - 40 = moderate
41+ = severe

The viral disease of the larvae and parasitism of the eggs laid in fall of 1991 greatly reduced the number of viable eggs that could hatch in spring of 1992. Egg parasitism averaged 30.4% and was over 80% in 9 of the 36 sample locations. All egg parasites had emerged prior to fall sampling and the identity of the species is not known.

Potentially, moderate and severe defoliation could occur on 6 100 ha in MU's 7 and 14 (Table 8, Fig. 11). An additional 10 200 ha is forecast to be lightly defoliated. However, the viral disease was present in all infestations and the potential severity of defoliation will not likely be realized in the forecast area.

Black Army Cutworm
Actebia fennica

Populations of this insect virtually collapsed in the 1988 and 1989 prescribed burnt areas near Northeast Pond on the Northern Peninsula. However, new infestations developed in small areas burnt in 1990 (both wildfire and prescribed burns) near Bellburns on the Northern Peninsula; as predicted from the 1990 pheromone trap-catch data. Damage to planted black spruce seedlings was generally light with the exception of small areas where high populations caused severe defoliation but very little mortality. A new infestation occurred in a 1989 wildfire area along the Cat Arm Road, near Jackson's Arm. Populations were high in this area, however defoliation was generally confined to hardwood vegetation, except for a small area of severe defoliation where a few black spruce seedlings were killed. Pheromone-baited traps were placed in areas where high

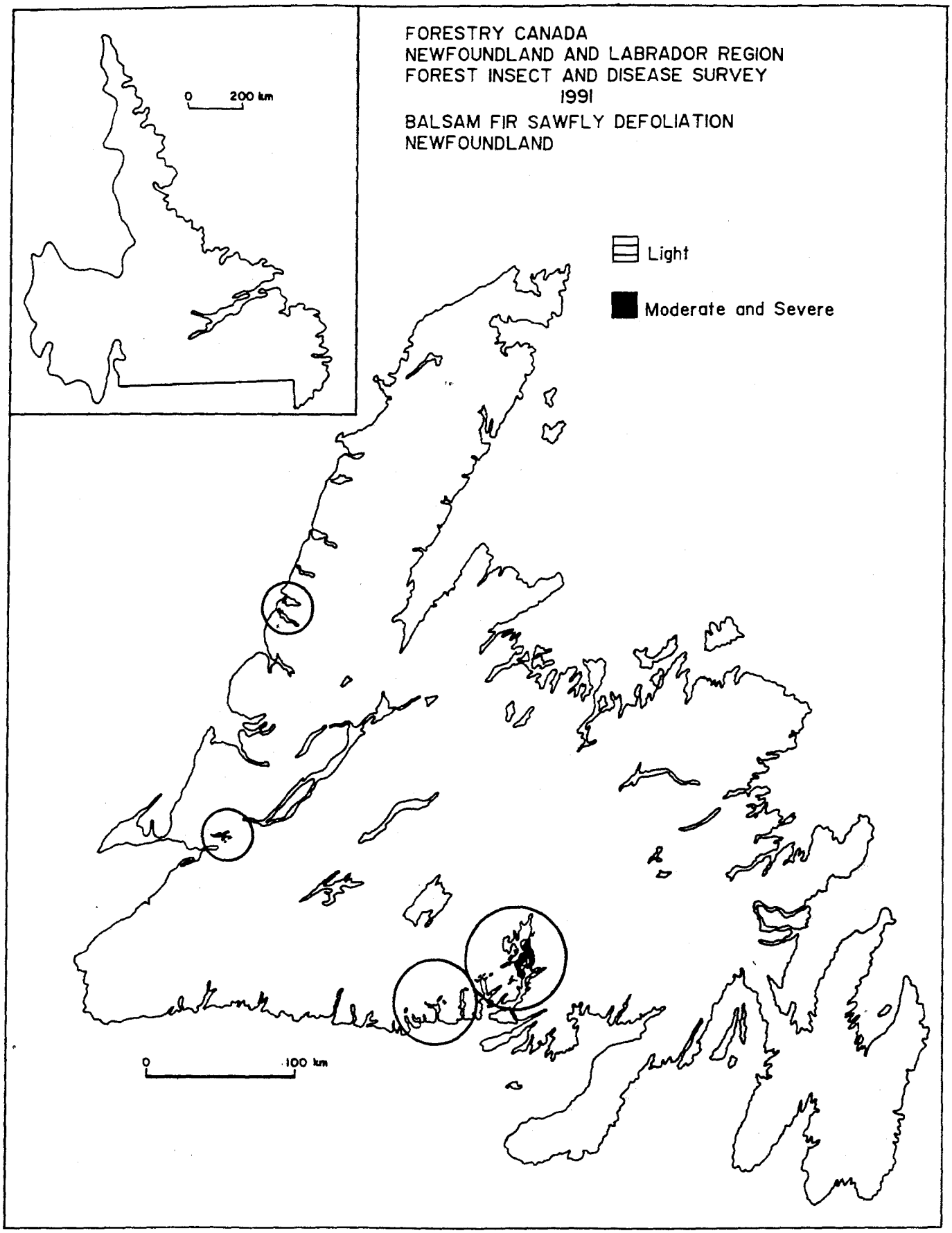

Figure 10. Areas of defoliation caused by the balsam fir sawfly in Newfoundland in 1991.

Table 8. Areas (ha) of defoliation by the balsam fir sawfly forecast in forested areas of Newfoundland for 1992.

Forest Management Unit	Defoliation Class*		
	Light**	Moderate & Severe**	Total
7	10 200	4 100	14 300
14	-	2 000	2 000
Total	10 200	6 100	16 300

*Light = 6% - 25%
Moderate = 26% - 75%
Severe = 76% - 100%

**Light = 6-20 eggs/branch; Moderate and Severe = ≥ 21 eggs/branch.

larval populations occurred in 1991 (Table 9). The highest number of moths caught was 195 at Cat Arm Road. Generally, this number is insufficient to indicate an outbreak for 1992.

During the 1991 season the lure produced by FPMI and the lure by Raylo Chemical were tested at 8 locations within the black army cutworm infestations, 4 at Cat Arm Road, 2 within the Bellburns infestation and 2 near Northeast Pond. The Raylo Chemical lure was much more efficient in attracting male black army cutworm moths than the FPMI lure (Fig. 12).

Spruce Bud Moth
Zeiraphera canadensis

The spruce bud moth attacks the current foliage of white and black spruce and was common in many areas of the Province in 1991. On the Avalon Peninsula from Goulds to Pouch Cove and at St. Catherines, Salmonier, high populations caused severe defoliation in natural spruce stands and on ornamentals and hedges. Ornamental trees and hedges in many communities on the Burin Peninsula also sustained varying degrees of damage. Several hectares of black spruce in the Arches Provincial Park in western Newfoundland were severely defoliated. The insect was common throughout the Upper Humber River watershed but did not cause significant defoliation.

European Pine Sawfly
Neodiprion sertifer

This sawfly was accidentally introduced to the Island in 1974 and was first recorded near Windsor Lake on the Avalon Peninsula. This insect has now spread to hard pines throughout St. John's, Mount Pearl and St. Thomas, Conception Bay. In 1991 a new infestation was discovered near Whitbourne, Trinity Bay, about 50 km west of other known infestations. New areas with moderate to high population levels of this pest occurred in 1991, and all infestations discovered were sprayed with Sertifervirus except the localized population near Whitbourne, which was discovered too late for treatment. This nuclear polyhedrosis virus successfully controlled the infestations and has been used to spray infestations from 1983 to 1991.

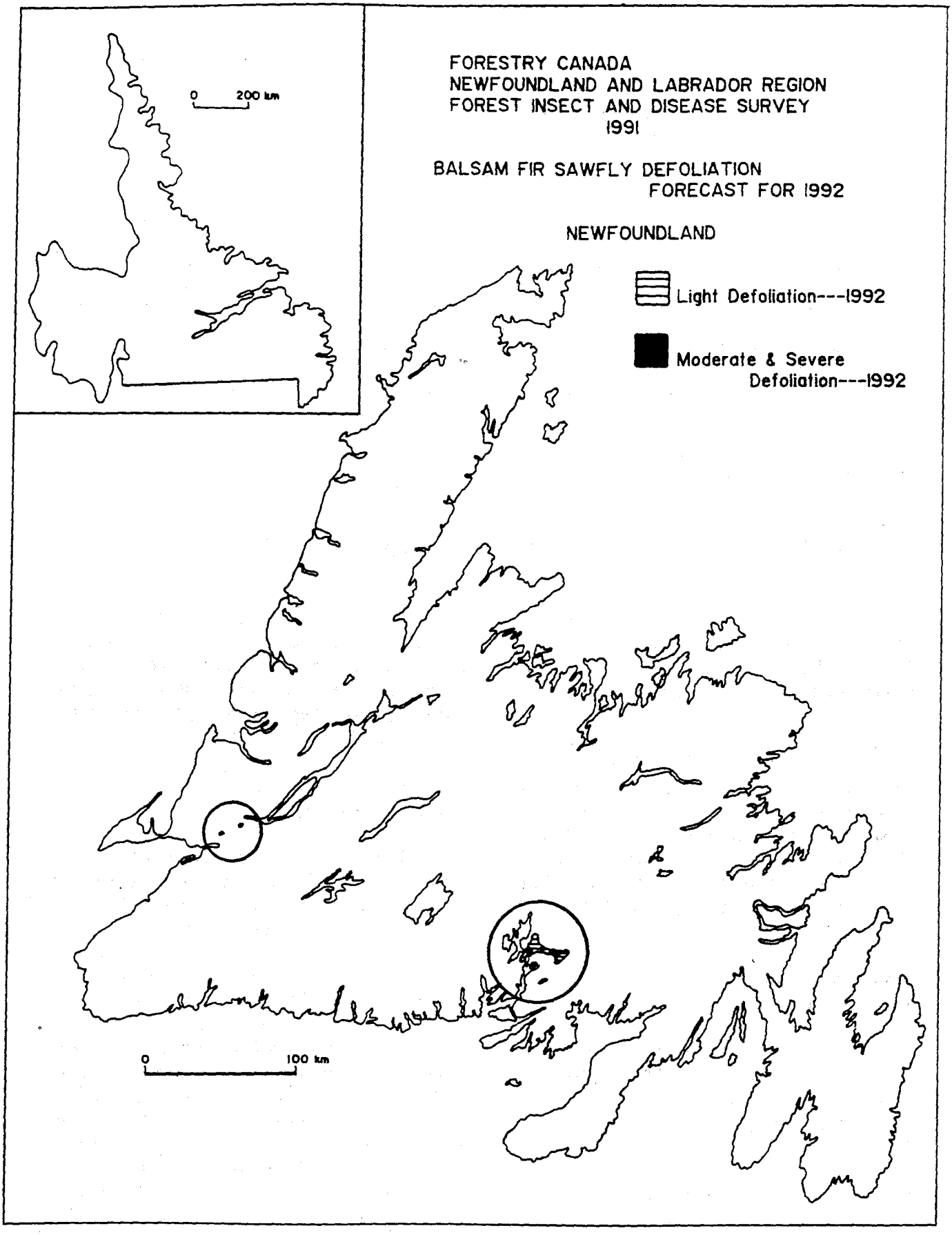

Figure 11. Areas of defoliation by the balsam fir sawfly forecast in forested areas of Newfoundland for 1992.

Table 9. Black army cutworm larval counts/m² and male moths caught in pheromone-baited traps in Newfoundland in 1990 and 1991.

Location	1990	1991	
	Avg. No. Adults/Trap	Avg. No. Larvae/1 m²	Avg. No. Adults/Trap
Bellburns (wildfire and prescribed burns)	164	30	96
Northeast Pond (prescribed burn)	97	4	70
Cat Arm Road (wildfire)	-	57	195
Fischells River (prescribed burn)	121	0	-
Fischells River (wildfire)	168	3	-

Larch Sawfly
Pristiphora erichsonii

No infestations of this sawfly were found in the Province in 1991. However, high larval numbers were recorded on scattered larch trees along the Pinchgut Lake Road in western Newfoundland. Defoliation ranged from 30% to 70%.

The Department of Forestry and Agriculture reported severe defoliation by the larch sawfly in western Labrador in 1991. The outbreak area extended from Hobdad Lake, Quebec east into Labrador to the Atikonak River and from the south end of Ashuanipi Lake north to the north end of Shabogamo Lake.

Shrew trapping in the four permanent sample plots across the Island continued in 1991 and a large increase in population levels (5 to 14 shrews/ha) occurred in 1991 compared to previous years' trapping (1 to 9 shrews/ha), and an opposite trend in 1990 when average densities ranged from 0 to 1 (Table 10).

Larch Beetle
Dendroctonus simplex

Increasing population levels of the eastern larch beetle were evident in 1990 in eastern Newfoundland. In 1991, a stand of Japanese larch was damaged by this pest and several trees were killed. Scattered larch trees along Holyrood Access Road on the Avalon Peninsula were also killed. Several other larch stands contained trees with chlorotic symptoms, characteristic of larch beetle attack. Such stands were observed on the Avalon Peninsula during an aerial survey, but their cause of death was not verified by ground examination. The first recorded outbreak in Newfoundland of this insect began in 1976.

Birch Casebearer
Coleophora serratella

This insect caused varying degrees of defoliation of white birch throughout the Island. Population levels increased in western and central regions of the Province causing pockets

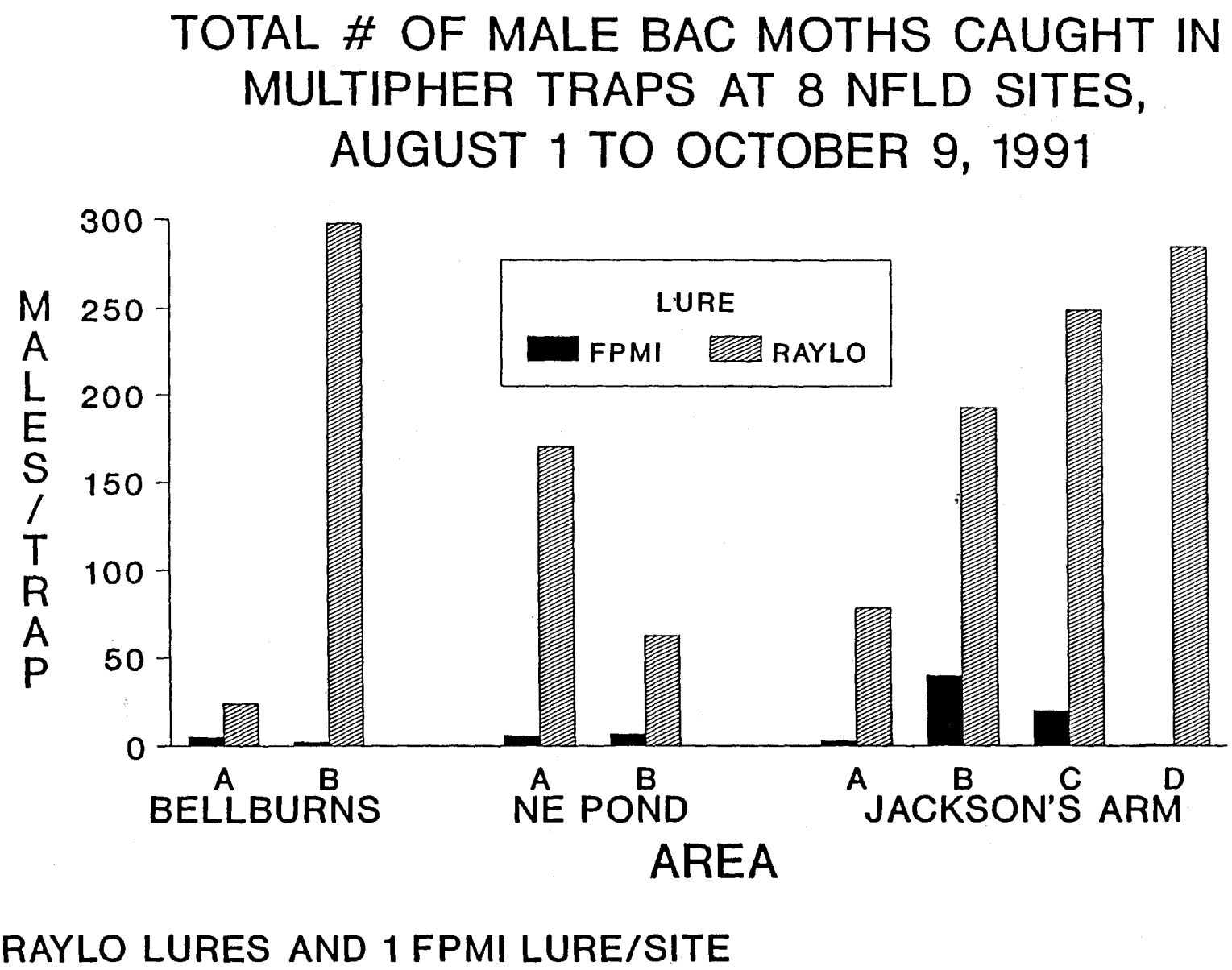

Figure 12. Total number of male black army cutworm moths caught in pheromone-baited multipher traps at eight Newfoundland sites from August 1 to October 9, 1991.

Table 10. Estimated number of shrews per hectare from 1986 to 1991 in Newfoundland.

Location	1986	1987	1988	1989	1990	1991
St. Georges	2.15	1.09	6.44	4.30	1.09	14.01
Hall's Bay	2.15	2.15	5.73	3.21	0.97	8.60
Terra Nova National Park	6.42	3.24	5.73	6.44	0.97	8.60
Paddy's Pond	5.39	4.30	-	8.60	0.00	5.36

of severe defoliation in many areas. In eastern Newfoundland, generally light damage occurred from Gander east to Goobies. Moderate to severe browning of foliage was also recorded in scattered areas on the Avalon and Burin Peninsulas.

Satin Moth
Leucoma salicis

Several outbreaks of this pest occurred throughout the Island in 1991. On the Baie Verte Peninsula, aspen and other ornamental poplars were severely defoliated. Outbreak populations were also recorded near Harpoon Brook and Constant Pond in central Newfoundland, near Terra Nova National Park and at Long Pond and Manuels on the Avalon Peninsula. Severe defoliation to ornamental poplars was also reported in Goulds.

Northern Spruce Engraver
Ips perturbatus

Populations of this *Ips* bark beetle continued to kill black spruce trees along the Churchill River from Goose Bay to Muskrat Falls and near the Caribou River in Labrador. Continued beetle activity was apparent in black and white spruce along the Naskaupi River bank near Seal Islands.

Poplar Serpentine Leafminer
Phyllocnistis populiella

An infestation of this leafminer continued in Labrador for the ninth consecutive year. Severe defoliation of trembling aspen occurred along the Lower Churchill River and adjacent river valleys in Labrador. Smaller areas of light defoliation occurred near the mouth of the Cache River. Crown dieback is beginning in those areas most severely defoliated for several years. Light defoliation was also evident in scattered areas in western and central Newfoundland.

Spearmarked Black Moth
Rheumaptera hastata

High larval numbers of this pest occurred in white birch stands in Middleton Lake area and near Badger in central Newfoundland, causing moderate to severe defoliation. Numerous adults of this insect were also observed in the Goose Arm area in western Newfoundland.

Spruce Beetle
Dendroctonus rufipennis

Mortality of mature white spruce caused by the spruce beetle occurred at widely scattered locations throughout western Newfoundland.

Trees usually were attacked singly or in groups of 2 to 5. The highest incidence of killed trees was observed in the lower Humber River Valley from Pasadena to Little Harbour and between Lomond Junction and Glenburnie in Gros Morne National Park.

Gypsy Moth
Lymantria dispar

A total of 300 pheromone-baited traps were placed at selected sites throughout the Island in cooperation with Agriculture Canada to detect accidental introduction of this pest to the Province. Forestry Canada placed 50 traps at 9 locations (Fig. 13). Only one male moth was trapped in Pippy Park, St. John's in 1991. Agriculture Canada increased the number of traps by 50 in Pippy Park this year because 2 males were trapped at the same location in 1990. A search for egg masses detected none.

Forest Tent Caterpillar
Malacosoma disstria

The pheromone-baited trap program to monitor the possible accidental introduction of this pest to the Island has continued since 1982. Numerous male moths were captured prior to 1985 when populations were at outbreak levels in the Maritime Provinces, but no moths have been trapped since. Population levels are increasing again in the Maritimes and have reached outbreak proportions in some localities, thus posing a new potential for introduction of this insect to Newfoundland.

A total of 100 traps were placed in parks, camping areas and near towns in permanent sampling areas (Fig. 14), and no moths were trapped in 1991.

DISEASES

Scleroderris Canker
Gremmeniella abietina

Two new infection sites of Scleroderris canker were recorded this year; one in Portugal Cove where 2 red pine were infected and the other in St. John's where the disease occurred on 3 Austrian pine. It was also recorded at various other locations throughout St.John's on Austrian pine. The disease was observed on Sitka spruce in a previously infected plantation near Roddickton with up to 10% of the foliage on some trees affected.

Armillaria Root Rot
Armillaria species

Armillaria root rot was recorded at Little Barachois Brook on balsam fir. Approximately .25 ha was affected with up to 10% of the trees dead or dying. Black spruce trees west of Flay Bay Brook were affected with the root rot. A low incidence of the disease was recorded on jack pine on the South Branch Road and at Kapitagas Channel, Eskimo River in Labrador.

Leaf and Shoot Blight of Aspen
Venturia macularis

A high incidence of leaf and shoot blight occurred on trembling aspen regeneration and severe damage was observed throughout a burnt area along the Cat Arm Road. Thirty percent of the aspen trees were affected along the Churchill River in Labrador. In St. Anthony aspen was infected with up to 20% of the foliage affected. The disease was also recorded along West Lake Road, Fogo, west of Lethbridge Forest Access Road, near Windsor Lake and in St. John's.

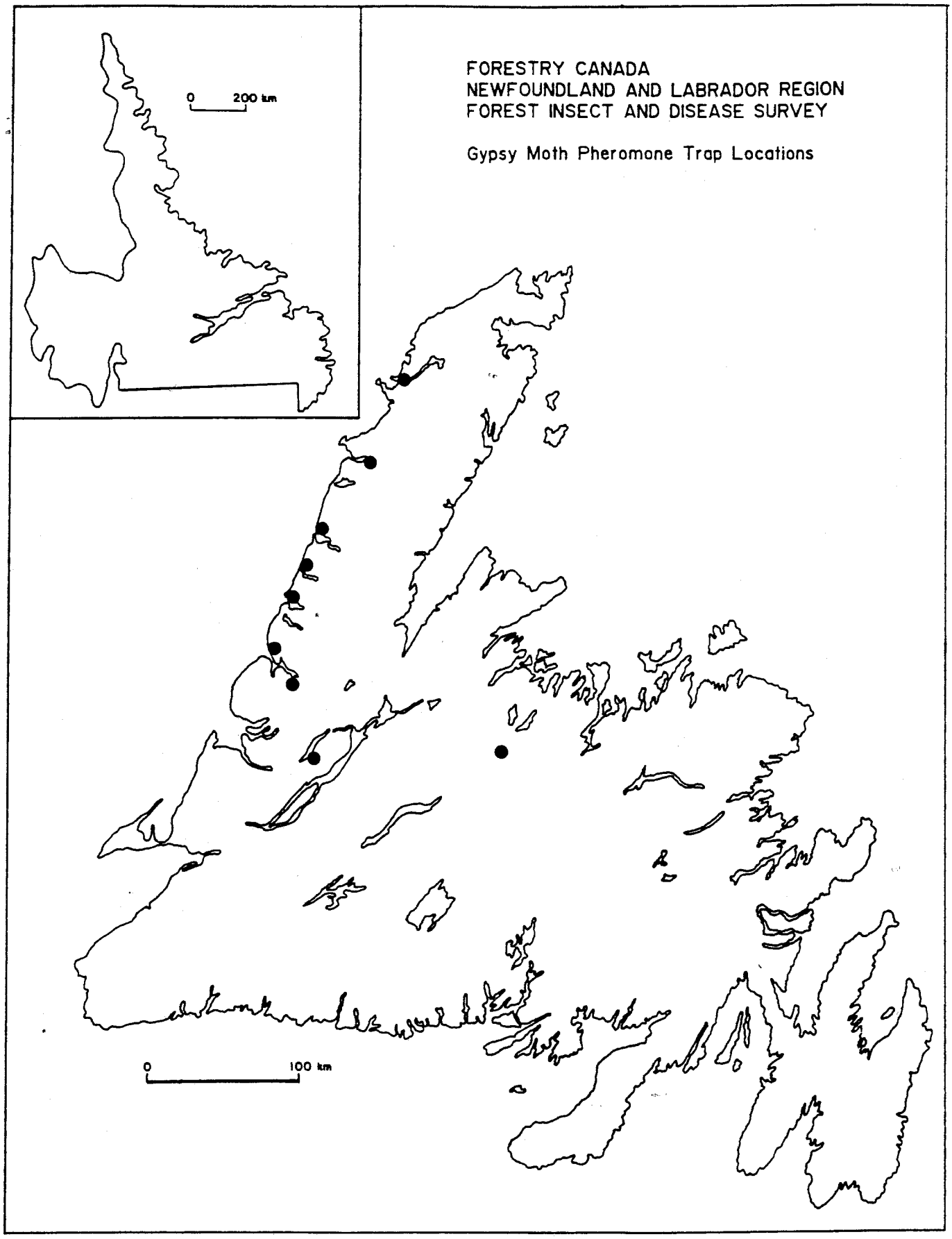

Figure 13. Gypsy moth pheromone trap locations.

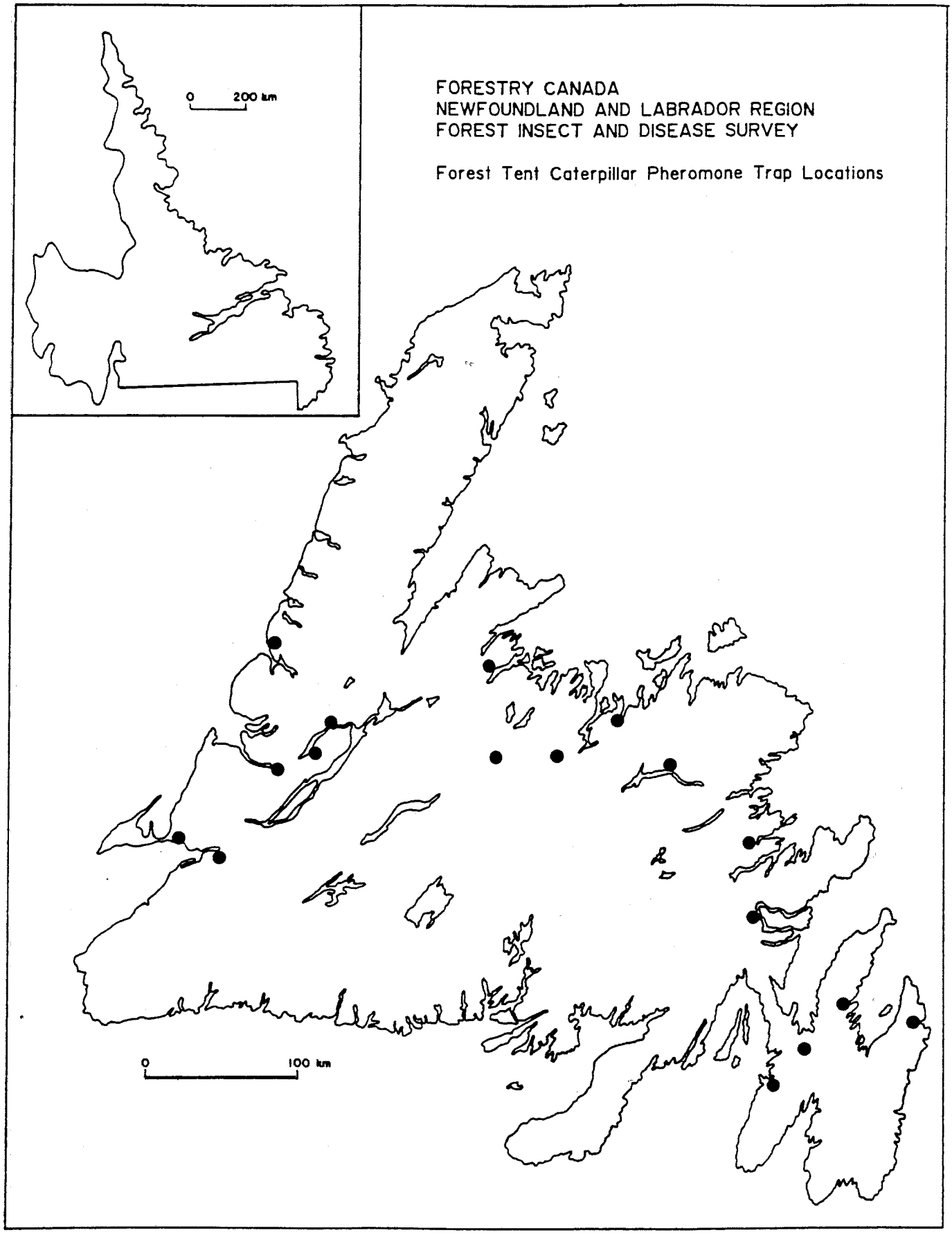

Figure 14. Forest tent caterpillar pheromone trap locations.

European Poplar Canker
Dothichiza populea

The European poplar canker disease continued to infect mostly Lombardy but also hybrid poplars in and around St. John's with up to 70% of the foliage affected.

Needle Rust
Chrysomyxa ledicola

Needle rust of black spruce was recorded on the South Branch Road in Labrador with up to 40% of the seedlings in the area affected. The alternate host, Labrador tea, was also infected with this disease in the same area. Several black spruce trees along the Goose River Road were affected and several black spruce trees near Bloomfield, Bonavista Bay. The rust disease occurred on Sitka spruce near Roddickton and on blue spruce near Rocky Pond.

Needle Cast
Isthmiella faullii

Up to 80% of the old foliage of balsam fir near Cape Caribou River in Labrador was affected by needle cast. In a thinned stand along Pinchgut Lake Road up to 40% of the old foliage of fir was affected on a few trees. The disease was also reported on fir near Cavendish, Backside Pond Provincial Park and near Hearts Content.

Dwarf Mistletoe
Arceuthobium pusillum

Dwarf mistletoe continued to spread on the black spruce study plot of 240 trees near Gambo. The total number of trees affected in 1991 increased by 15% to 98 trees.

Ink Spot
Ciborinia whetzelii

A severe infection of ink spot occurred near Naskaupi River in Labrador where 30% to 90% of the foliage was affected on most trees in several small young trembling aspen stands in the area. Northwest of Otter Creek in Labrador up to 20% of the foliage of 90% of the trees were affected with ink spot. A low incidence of this disease was recorded near Happy Valley where 10% of the foliage was affected. On the Island infection was also recorded along West Bottom Brook Road and Lethbridge Forest Access Road where up to 90% incidence occurred on some trees.

Nectria Canker and Dieback
Nectria cinnabarina

Nectria canker and dieback was common and widespread throughout St. John's, with up to 5% of the branches of various maple species exhibiting dieback symptoms.

Septoria Leaf Spot
Septoria betulae

All young white birch trees in a plantation near Roddickton were infected with Septoria leaf spot with up to 90% of the foliage affected.

Shot Hole
Coccomyces hiemalis

Moderate damage of shot hole occurred on pin cherry near Burlington, east of Charleston and Three Island Pond. Up to 20% of the foliage was affected on most trees.

ANIMALS

Moose - Severe damage by moose to young balsam fir stands, particularly stands recently thinned, occurred in many areas in central and western Newfoundland. The severest damage occurred in wintering yards. The total area of thinned stands severely damaged was estimated at over 1 000 ha.

Moderate damage by moose browsing occurred in jack pine plantations along the South

Branch Road in Labrador, causing multiple leaders.

Porcupine - A few jack pine saplings were damaged near Peter River in Labrador. Porcupines were attracted by the increased resin flow caused by Armillaria infections. Spruce and fir were damaged by porcupines in widely scattered areas in eastern Labrador.

Red Squirrel - Damage to the tips of black spruce continued in 1991. Characteristic tufted tree tops occurred in many parts of the Island and throughout Labrador.

ABIOTIC DAMAGE

Frost Damage - A high incidence of frost damage occurred to Japanese larch on the south side of the Churchill River near Muskrat Lake where up to 70% of the foliage was affected on 90% of the trees. On the South Branch Road east of Echo Lake 50% of the new foliage was affected on 10% of the Japanese larch trees. A low incidence was recorded on Japanese larch along the Churchill River Road. A jack pine plantation on the Churchill River Road was also affected. Up to 10% of the white spruce seedlings along the Grand Lake Road in Labrador were affected by frost causing multiple leaders. The new foliage of black spruce was affected along the Mill Pond Forest Resource Road near Northern Arm.

Snow Damage - Many black spruce plantations in western Newfoundland showed evidence of snow damage that had occurred four to five years ago. Multiple leaders were common as were distinct crooks in the main stem.

Winter Drying - High incidences of winter drying occurred to jack pine in a planation north of Catalina where up to 50% of the foliage was affected on 70% of the trees and to balsam fir regeneration east of Green's Harbour where needles had turned red. Winter drying caused the death of many basal branches of black spruce along the Grand Lake Road and the South Branch Road in Labrador.

Late Spring Leaf Scorch - Late spring leaf scorch affected mostly maples in the St. John's area with up to 30% of the foliage affected. Scorch damage was also recorded on maple and oak in Gander.

Effects of High Temperatures - High temperatures in St. John's caused the bark on the main stem of some maple trees to crack. Apparently this is caused by rapid increase in diameter growth.

OTHER INSECTS, DISEASES OR DAMAGE

Insect, disease or damage	Host(s)	Location	Remarks
Ambrosia beetle *Trypodendron lineatum*	Balsam fir	Eastern Labrador	Killed trees stressed by high water levels.
Anthracnose *Kabatiella apocrypta*	Red maple Mountain maple	Central & eastern Newfoundland, Avalon Peninsula	Up to 80% of the foliage affected on urban trees.
Apple scab *Venturia inaequalis*	Flowering crab	St. John's	Up to 20% of the foliage affected on urban trees.
Aspen leafroller *Pseudexentera oregonana*	Trembling aspen	Central & eastern Newfoundland, Avalon Peninsula	Light damage.
Balsam twig aphid *Mindarus abietinus*	Balsam fir	Central & eastern Newfoundland, Northern Peninsula	Low to moderate populations. Light damage.
Black knot *Apiosporina morbosa*	Pin cherry Damson plum	Central Newfoundland, Avalon Peninsula	High incidences.
Blight *Pestalotiopsis funerea*	Juniper	St. John's	New record.
Broom rust *Melampsorella caryophyllacearum*	Balsam fir	Northern & Avalon Peninsulas	Up to 30% of the foliage affected and up to 4 brooms per tree.
Cytospora canker and dieback *Cytospora kunzei*	White spruce	Avalon Peninsula	Low to moderate incidence.
Cytospora salicis	Willow	Western Newfoundland	Low incidence.
European pine shoot moth *Rhyacionia buoliana*	Scots pine	Central & eastern Newfoundland	Severe damage to ornamental pines in Grand Falls and near Topsail Pond on the Avalon Peninsula.
European spruce sawfly *Gilpinia hercyniae*	White spruce Black spruce	Throughout Newfoundland	Low numbers.
Fall webworm *Hyphantria cunea*	Willow	Central Newfoundland	Low numbers.

OTHER INSECTS, DISEASES OR DAMAGE (Cont'd.)

Insect, disease or damage	Host(s)	Location	Remarks
Green balsam looper *Cladara limitaria*	Balsam fir White spruce	Throughout Newfoundland	Populations low.
Greenheaded spruce sawfly *Pikonema dimmockii*	Black spruce White spruce Balsam fir	Throughout Newfoundland	Low numbers.
Larch casebearer *Coleophora laricella*	Tamarack	Western Newfoundland	50% defoliation along Camp 180 Road.
Leaf and shoot blight *Pollacia elegans*	Balsam poplar Silver poplar	Northern & Avalon Peninsulas	Moderate incidence primarily to lower crown.
Leaf rust *Gymnosporangium cornutum*	American mountain-ash	Avalon Peninsula	Low incidence.
Melampsora abieti-capraearum	Willow	Western Newfoundland	Low incidence.
Leaf spot *Marssonina brunnea*	Hybrid poplar	St. John's	A trace of damage to urban trees.
Mountain-ash sawfly *Pristiphora geniculata*	American mountain-ash Showy mountain-ash	Western & eastern Newfoundland	Moderate to high numbers. Light to moderate defoliation.
Mourning cloak butterfly *Nymphalis antiopa*	Willow	Western Newfoundland	Moderate populations, 30% defoliation.
Nectria canker and dieback *Nectria galligena*	Sycamore maple	Avalon Peninsula	Two urban trees dying and one dead.
Needle rust *Chrysomyxa ledi*	Black spruce White spruce	Eastern Newfoundland, Northern Peninsula, Eastern Labrador	Up to 40% of black spruce seedlings affected in eastern Labrador.
Coleosporium asterum	Jack pine	Bonavista Peninsula	A low incidence in a jack pine plantation.
Pucciniastrum epilobii	Balsam fir	Eastern Labrador	Low incidence. 10% current foliage affected.
Orange spruce needleminer *Coleotechnites piceaella*	Balsam fir Black spruce	Central & eastern Newfoundland	Populations low.

OTHER INSECTS, DISEASES OR DAMAGE (Concl'd.)

Insect, disease or damage	Host(s)	Location	Remarks
Phomopsis blight *Phomopsis juniperovora*	Cedar Juniper	St. John's	Low incidence.
Phomopsis occulta	Norway spruce	Central Newfoundland	New record. Low incidence in a nursery.
Rusty tussock moth *Orgyia antiqua*	Balsam fir White spruce	Western, central & eastern Newfoundland	Low numbers.
Seed or cold fungus *Caloscypha fulgens*	White spruce	Central Newfoundland	New record. Stratified white spruce seeds affected.
Sirococcus shoot blight *Sirococcus strobilinus*	Blue spruce	Avalon Peninsula	A new host record. Low incidence.
Snow blight *Phacidium infestans*	Black spruce	Goose Bay, Labrador	Lower 30% of the crown in plantations.
Spruce bud scale *Physokermes piceae*	Black spruce	Central Newfoundland	High numbers. Light damage.
Stillwell's syndrome	Balsam fir	Eastern Labrador	Mortality of scatttered trees in river deltas.
Taphrina witches' broom *Taphrina cerasi*	Pin cherry	Central Newfoundland	Low incidence.
Uglynest caterpillar *Archips cerasivorana*	Pin cherry	Western Newfoundland	Nests common in the Deer Lake to Little Rapids area.
White pine blister rust *Cronartium ribicola*	White pine	Central Newfoundland	High incidence.
White pine needleminer *Ocnerostoma strobivorum*	Jack pine	Mount Pearl	High numbers. Moderate damage.
Willow blight *Fusicladium saliciperdum*	Willow	Eastern Newfoundland, Avalon Peninsula	Low incidence.
Glomerella miyabeana	Willow	Eastern Newfoundland, Avalon Peninsula	Low incidence.

APPENDIX I

Spruce budworm pheromone trap locations and total number of larvae, adults and overwintering larvae collected in Newfoundland in 1991.

Plot No.	Location	No. Larvae (June & July)	No. Adults (August)	No. Over-wintering Larvae (October)
1	Overfalls Brook	1	143	10
2	Codroy Pond	16	1773	893
3	Mitchells Pond	1	95	377
4	Fishells River	0	63	156
5	Barachois Brook	0	116	288
6	Trout Brook	1	314	0
7	Campbells Creek	1	651	193
8	Gallants Road	0	28	0
9	George's Lake	0	37	18
10	Pinchgut Lake Road	0	84	0
11	Corner Brook Stream	0	44	0
12	South Brook Valley	0	56	0
13	Bay of Islands	6	788	29
14	Goose Arm Road	0	25	0
15	Big Bonne Bay Pond	0	12	28
16	Lomond	0	91	70
17	East Arm, Bonne Bay	1	81	122
18	Sally's Cove	3	538	0
19	Daniel's Harbour	0	48	29
20	Hawkes Bay	0	50	0
21	Ten Mile Lake	0	40	0
22	Birchy Lake	0	18	0
23	Black Brook	0	39	0
24	Burlington Road	0	55	67
25	LaScie Road	0	41	110

APPENDIX I (Concl'd.)

Plot No.	Location	No. Larvae (June & July)	No. Adults (August)	No. Over-wintering Larvae (October)
26	West Brook Road	0	50	28
27	Gullbridge Mines Road	0	75	64
28	Catamaran Park	0	26	0
29	Aspen Brook Road	0	11	0
30	Buchans Highway	0	20	0
31	Exploits Dam	0	23	0
32	Quinn Lake	0	12	0
33	New Bay Pond Road	0	30	0
34	Exploits River	0	65	77
35	Tote Brook	0	10	0
36	Bay d'Espoir Highway, Northwest Gander River Bridge	0	19	24
37	Bay d'Espoir Highway at Gull Pond	1	19	0
38	Twillick Brook	0	50	59
39	St. Joseph's	0	108	0
40	Burnt Woods Road, Bay d'Espoir	0	80	76
41	Gander Bay Road	0	43	68
42	Glenwood	0	0	10
43	Gambo	0	44	53
44	Charlottetown Jct., TNNP	0	47	433
45	Thorburn Lake	0	16	366
46	TCH, Hillview Jct.	0	25	0
47	Whitbourne	0	6	0
48	Heart's Content	0	50	128
49	Salmonier Line	48	10	1076
50	Logy Bay	0	20	164

APPENDIX II

Decision points used to forecast defoliation categories of major defoliators in Newfoundland for 1992.

Hemlock Looper - Average Eggs/branch

(5 lower to mid-crown branches)

Nil	=	0
Trace	=	<1
Light	=	1-3
Moderate	=	4-9
Severe	=	10^{+}

Spruce Budworm Overwintering Larval Categories - Average Larvae/10 m^2

(3 mid-crown branches)

Nil	=	0
Trace	=	1-34
Light	=	35-108
Moderate	=	109-323
Severe	=	324-700
Extreme	=	700^{+}

Spruce Budworm Egg-mass Categories - Cumulative Eggs/10 m^2

(3 mid-crown branches)

Branch No.	Light	Uncertain	Severe
1	-	0-337	>337
2	<149	149-505	>505
3	<315	315-672	>672

APPENDIX II (Concl'd.)

Blackheaded Budworm - Average Eggs/10 m^2

(5 upper-crown branches)

Nil	=	0
Trace	=	1-49
Light	=	50-400
Moderate	=	401-800
Severe	=	801-1600
Extreme	=	1600^+

Balsam Fir Sawfly - Average Eggs/branch

(5 mid-crown branches)

Nil	=	0
Trace	=	1-5
Light	=	6-20
Moderate	=	21-40
Severe	=	41^+