THE DECLINE OF GRAY PARTRIDGE *Perdix perdix* AND RING-NECKED PHEASANT *Phasianus colchicus* ON PRINCE EDWARD ISLAND, 1955-61.

By

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C O N T E N T S

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Introduction

In 1962 the Canada Department of Northern Affairs and National Resources was asked to provide assistance to the Government of Prince Edward Island in determining the reasons for a sharp decline in the numbers of Gray Partridge (*Perdix perdix* (L.)) and Ring-necked Pheasant (*Phasianus colchicus* L.) in the Province. In 1963, I went to Prince Edward Island on behalf of the Canadian Wildlife Service, in co-operation with the Government of Prince Edward Island, to study the local history and ecology of partridge and pheasant.

Objectives

(1) To determine the history of partridge and pheasant on Prince Edward Island.

(2) To assess the past and present status of the two species on the Island.

(3) To determine the reasons for the decline of partridge and pheasant on Prince Edward Island.

(4) To consider the feasibility of stocking and management as means of improving natural survival of partridge and pheasant, and of providing better hunting of the two species.

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[1] The Gray Partridge is known to North American sportsmen as the "Hungarian Partridge", because some of the introduced stock was procured in Hungary.

Methods

Methods of collecting data for the study were:

(1) Study of scientific literature on partridge and pheasant.

(2) Extraction of data from published and unpublished reports of the Governments of Canada and Prince Edward Island, and from records of sportsmen's organizations of Prince Edward Island.

(3) Interviews with persons familiar with partridge and pheasant on Prince Edward Island.

(4) Personal observations of the habitat for partridge and pheasant on Prince Edward Island.

The Province

Situation - Prince Edward Island lies in the Gulf of St. Lawrence, nine to 14 miles off the east coast of New Brunswick and the north coast of Nova Scotia. It forms a gentle crescent, with the ends pointing to the east and the northwest.

Description - The Island is about 145 miles long and four to thirty-five miles wide, with a total area of about 2,814 square miles or 1,400,000 acres.

Topography

Soils - Whiteside (1950) gives a thorough discussion of Prince Edward Island soils. Physiographically, the three maritime provinces of which P.E.I. is one, comprise the Canadian Section of the Atlantic Coastal Plain, also

referred to as the Acadian Region. Prince Edward Island is underlain by sedimentary rocks, mainly soft, red sandstone, arenaceous shale and red conglomerate, with some grey sandstone and concretionary limestone. They are of Upper Carboniferous and Permian age. The red colour of the rocks, which extends to the soils, is due to the presence of iron pigments.

Small deposits of concretionary limestone occur at different places in the Province, chiefly at Minimigash and Crown Point. V. Prest (pers. comm.) noted limestone in the Tignish area and stated that the best deposits were found in the Parks Corner area northeast of Kensington. The limestone deposits are described by Whiteside as small lenses or ledges exposed at low tide. Prest described the deposits he found as calcareous shale breccia.

Overlying the bedrock is a mantle of till and stratified sediments. The till appears to be made up of material which has been transported from outside the Province and to a lesser extent from native bedrock, which apparently was feebly glaciated. Small fluvio-glacial deposits have been reported, chiefly from Kings County. Other local sediments are sand dunes along the coasts, and organic deposits, found throughout the Island. The latter vary from alder swamps to deep deposits of peat covered with ericaceous growth.

Whiteside (1950) has divided the soils of Prince Edward Island into six groups on the basis of value for agriculture. In descending order of suitability for agriculture they are: (1) better and potentially better agricultural land; (2) good to fair agricultural soils; (3) fair to marginal agricultural soils; (4) marginal agricultural lands; (5) sub-marginal lands; (6) non-agricultural lands.

Group 1

Soil Series	Acres	Per cent of Total Area
Alberry	270,410	19.7
Charlottetown	443,370	32.4
O'Leary	62,605	4.6
	776,385	56.7

Most of these soils are under cultivation.

Group II

Soil Series	Acres	Per cent of Total Area
Haliburton	27,340	2.0
Pownal	4,900	0.4
Queens	3,200	0.2
	35,440	2.6

The moisture characteristics of this group are not as good as those of Group I.

Group III

Soil Series	Acres	Per cent of Total Area
Culloden	177,655	13.0
Kildare	18,210	1.3
	195,865	14.3

Poor moisture characteristics limit the usefulness of this group.

Group IV

Soil Series		Acres	Per cent of Total Area
Alberry	)	41,400	3.2
Charlottetown	) Rolling phase	40,600	2.8
Egmont		59,180	4.3
		141,180	10.3

This group is marginal because of the hilly nature of the region, erodibility of the soil, and poor natural drainage.

Group V

Soil Series	Acres	Per cent of Total Area
Dunstaffnage	33,865	2.5
Armadale	141,760	10.4
	175,625	12.9

Profile and topography result in poor drainage of these soils.

Group VI

Soil Series	Acres	Per cent of Total Area
Alberry	6,500	0.5
Charlottetown	2,100	0.2
Culloden	15,310	1.1
Peat	9,790	0.7
Salt Marsh	2,775	0.2
Dune Sand	7,020	0.5
	43,495	3.2

Poor topography and drainage, susceptibility to severe erosion, and high cost of reclamation and maintenance make these soils unsuitable for agriculture.

The approximate distribution of the larger areas of these groups is shown in Figure 1.

To the agriculturalist, the major soil problems are low fertility, excess acidity, erodibility, and poor moisture conditions. The latter may be either an over-abundance of ground water, or poor moisture-holding capacity. Low fertility, common throughout the Island, is due to climate and to the nature of the parent material which promotes severe leaching. Factors lowering soil fertility cited by Whiteside (1950) are: (1) poor soil structure; (2) low organic matter content, and (3) high acidity.

The approximate distribution of soil problem areas is shown in Figure 2.

In order to counteract the low pH of the soils, limestone dressings are applied to the fields. Prior to the use of limestone, land was "mudded" with "mussel mud". This material, consisting of river mud or marine silt and shell material, was carried onto and spread over fields. "Mudding" has not been practised for 25 years or more, but its effect on soil pH is still detectable. The experience of farmers has shown that soils which have been mudded do not require lime, and show little response if they are limed. Whiteside (1950) noted that ..."mussel-mud not only provides a continuing supply of calcium but it is also distributed deeper in the soil than is general where lime has been used."

A sufficient supply of calcium must be added to overcome the acidity of the soil. It is also necessary for plant growth. However, it is important to avoid too high a concentration because of the possibility of encouraging the growth of a potato scab (Actinomyces scabies) (Whiteside 1950). On the specialized potato farms or where potatoes (Solanum tuberosum) are an important crop in the rotation, not more than one ton of lime per acre should be used (Whiteside 1950). The amount of lime used on Prince Edward Island soils has increased over the past several years (Table 1).

Table 1 - Amount of limestone applied to agricultural soils on Prince Edward Island, 1950-1962.[1]

Year	Limestone Used (tons x 10^3)	Year	Limestone Used (tons x 10^3)
1950	24	1957	24
1951	25	1958	28
1952	30	1959	Unknown
1953	24	1960	34
1954	22	1961	35
1955	25	1962	32
1956	24		

[1] Pers. comm. D.C.MacKay, November 20, 1963.

Climate

Prince Edward Island is protected on the west by New Brunswick and on the south by Nova Scotia. The climate, may be described as cool temperate, with freezing winters and moderately warm summers. The cooling effect of drifting ice in the Gulf of St. Lawrence delays the spring. The mean date of the last frost at Charlottetown is May 13, but it may vary as much as two weeks (Table 2). The moderating effect of the sea delays the autumn frosts until mid-October permitting a long growing season (Table 2). The climate is slightly more maritime in the east and more continental in the west.

The mean annual precipitation is 42.41 inches at Charlottetown (monthly mean 3.35 inches), and 40.22 inches at Summerside (monthly mean 3.35 inches). At Charlottetown and Summerside 10.7 inches and 12.0 inches, respectively, of the precipitation is snow. Sixty-eight per cent of the snow at Charlottetown, and 86.4 per cent of the snow at Summerside, falls between December and March. The season with the heaviest rainfall is the autumn, September to November, with 11.43 inches falling at Charlottetown and 11.07 inches at Summerside (Table 3). Complete thaws are common in January. The mean annual temperature for the Island is about 43.0 F. (Table 4).

The average frost free period is 155 days (52 year average) at Charlottetown and 152 days (36 year average at Summerside (Table 2). A comparison of those figures with

Table 2 - Summary of frost data records for Charlottetown and Summerside.

	Last frost in spring		First frost in fall		No. of Frost free days	No. of killing frost free days
Location	Date	Temp.	Date	Temp.	32° F+.	28° F+.
Charlottetown (52 yr. mean)	May 13	32	Oct 15	32	155	193
Summerside (36 yr. mean)	May 15	31	Oct 14	31	152	183

Table 3 - Mean monthly, seasonal, and annual precipitation for Charlottetown and Summerside.

Month and Season	Average Monthly Fall Ch'town[1]	Fall S'side[2]	Rain Ch'town	Rain S'side	Snow Ch'town	Snow S'side
December	4.34	3.46	2.05	1.77	22.8	16.9
January	4.13	3.70	1.50	1.60	26.0	21.0
February	3.41	3.59	0.94	1.32	24.8	22.7
Winter Total	11.88	10.75	4.49	4.69	73.6	60.6
March	3.38	3.05	1.49	1.31	18.9	17.4
April	2.95	2.71	2.18	2.08	7.8	6.3
May	2.88	3.24	2.83	3.18	0.5	0.6
Spring total	9.21	9.00	6.50	6.57	27.2	24.3
June	2.94	2.92	2.93	2.93	0.0	0.0
July	3.03	2.79	3.03	2.79	0.0	0.0
August	3.34	3.29	3.34	3.29	0.0	0.0
Summer Total	9.31	9.0	9.31	9.0	0.0	0.0
September	3.84	3.53	3.84	3.53	0.0	0.0
October	4.06	3.35	4.02	3.35	0.4	0.2
November	4.11	4.59	3.57	4.19	5.8	4.0
Fall Total	12.01	11.47	11.43	11.07	6.2	4.2
Yearly Total	42.41	40.22	31.72	31.33	107.0	120.4

[1] 53 year average
[2] 19 year average

Table 4 - Monthly, seasonal, and annual mean temperatures for Charlottetown and Summerside.

Month and Season	Temperature Mean Max. Ch'town[1]	Mean Max. S'side[2]	Mean Min. Ch'town	Mean Min. S'side	Mean Ch'town	Mean S'side
December	31.7	31.6	19.3	18.9	25.5	25.3
January	26.9	26.8	11.7	12.5	19.2	19.7
February	26.1	27.8	10.3	13.4	18.3	20.6
Winter Mean	28.2	28.7	13.8	14.9	21.0	21.9
March	33.7	33.5	19.9	20.9	26.9	27.2
April	44.6	44.8	30.1	30.7	37.4	37.8
May	57.4	57.2	39.8	40.2	48.6	48.7
Spring Mean	45.2	45.2	30.0	30.6	37.6	37.9
June	68.8	66.6	50.6	49.9	59.7	58.3
July	75.9	76.4	58.9	58.3	67.6	66.5
August	74.8	72.9	58.4	57.6	66.6	65.3
Summer Mean	73.2	72.0	56.0	55.3	64.6	63.4
September	66.9	66.0	51.4	51.0	59.1	58.5
October	56.4	54.9	48.0	41.4	49.2	48.2
November	43.4	43.5	31.7	32.1	3.75	3.78
Fall Mean	55.6	54.8	41.7	41.5	48.6	48.2
Yearly Mean	50.6	50.2	35.4	35.6	43.0	42.9

[1] 53 year average
[2] 19 year average

data from the mainland showed that Prince Edward Island has a longer frost-free period than is general for eastern Canada. It is 17 days longer than at Sackville, N.B., and 38 days longer than at Nappan, N.S. (Whiteside, 1950).

Vegetation

The relevant vegetation associations of Prince Edward Island are named and described briefly below (after Erskine, 1960).

I - Forest

On the uplands the forest is of the northern hardwoods type, composed of beech (Fagus grandifolia), sugar maple (Acer sacharum), yellow birch (Betula lutea), and their coniferous associates, white pine (Pinus strobus) and hemlock (Abies balsamea). Typically, ground cover is sparse, and the scrub layer is almost lacking. The striped maple (Acer pennsylvanicum) and the mountain maple (Acer specatum) are much less common than the dominant sugar maple. The herbs are for the most part spring perennials.

On the lowlands, greater habitat diversity has led to the development of a more heterogeneous forest. Stream valley clays of the western part of the province support red maple (Acer rubrum) forest associations, now mainly in alder (Alnus spp.), elms (Ulnus sp.) elder (Sambucus canadensis), virgin's-bower (Clematis virginiana), and high-bush cranberry (Viburnum tribolium), with willow (Salix lucida) in wet places.

With the exception of ash (*Fraxinus spp.*) , the same association is found along the larger rivers of the north slope, east of Prince County. Red maple is characteristic of the depressions of the sandy east and central lowlands.

Glacial and marine sands in the lowlands support a very different forest type, dominated perhaps by white pine, or white pine and wire birch (*Betula populifolia*) in the most gravelly sites. The most extensive stands of cedar (*Thuja occidentalis*) occur in western Prince County, where the sands are slightly above the water table. Black spruce (*Picea mariana*) dominates the true swamps of the lowlands almost exclusively except on the borders of the bogs, where larches (*Larix laricina*) replace them.

II and III - Freshwater and maritime communities

Descriptions of these associations are provided by Erskine (1960). They are omitted here as they do not support upland game birds.

IV - Bogs

The bog community is dominated by peat moss (usually *Sphagnum subsecundum*). The bogs contain leatherleaf (*Chamaedaphne calyculata*) and cotton grass (*Eriophorum angustifolium*), and islands of stunted larch and black spruce. These islands include wild holly (*Nemopanthus macronata*), chokeberry (*Aronia prunifolia*) and service berry (*Amelanchier fernaldii*). Cloud-

berry (Rubus chamaemorus) and low bush cranberry (Vaccinium oxycoccus) are found on the peat hummocks.

V - Cultivated Vegetation

The acreages and distribution of cultivated crops on Prince Edward Island are shown in Table 5. The agriculture of the Province is described below.

Agricultural Practices - Crop rotation is the rule. Erskine (1960) found that hay crops were usually sown as timothy-clover mixtures, with either red clover or alsike. Most of the clover would disappear by the second year, and the field would usually be used for pasture in the fifth year. On farms with much land in potatoes, grain and clover hay were planted in rotation every three years; cattle farmers practised a grain - clover hay- timothy - rotation. In addition to land used in rotation for pasture, there were also permanent pasture lands that were never tilled.

Tractors have increased steadily in number on Prince Edward Island farms since the early 1940's (Tables 6 and 7). Mechanization has led to an increase in the size of farms, and to the abandonment of fields not suited to mechanical cultivation. Mechanization and improved management techniques have increased the prosperity of the larger scale farmers, but has placed the small farmers in an increasingly precarious position. Enlistment during the 1939-45 war, and post-war industrial expansion in central Canada, drained many young

Table 5 - Distribution, by county, of cultivated crops on Prince Edward Island, 1961.[1]

	COUNTY			
Crop -(Acres)	Kings	Prince	Queens	Total
Wheat	622	2,128	1,306	4,056
Oats	18,688	40,059	38,958	97,705
Barley	381	360	427	1,168
Mixed grain	7,599	15,784	28,913	52,096
Rye	15	1	151	167
Buckwheat	33	69	107	209
Peas	2	0	150	152
Beans	0	46	46	92
Seed corn	24	40	39	103
Tame hay	33,603	69,010	75,942	178,555
Oats cut for hay	517	1,010	654	2,181
Forage corn	190	462	623	1,275
Oats cut for forage	105	209	264	578
Flax	0	3	0	3
Potatoes	8,610	23,651	13,912	46,173
Turnips and sweet mangels	626	698	2,203	3,527
Sugar beets	0	0	35	35
Tobacco	90	0	10	100
Other grains	1	3	8	12

[1]Modified from original table - 1961 Census of Canada, Agriculture, Prince Edward Island, Vol. 5, Part 1.

Table 6 - Numbers of farm machines used on Prince Edward Island, 1921-1961.[1]

Item	1921	1931	1941	1951	1956	1961
Autos	?	3,885	3,570	4,147	4,511	4,713
Motor trucks	..	369	494	1,679	3,247	3,253
Tractors	49	176	577	2,776	4,840	5,713
Grain combines	..	0	4	18	238	644
Grain binders	..	7,204	..	5,856	..	3,220
Threshing machines	..	3,238	3,015	2,973	..	1,656
Pick-up balers	..	..	..	..	..	1,047
Forage crop harvesters	..	..	..	..	..	74

[1] Modified from original Table, 1961 Census of Canada, Agriculture, Prince Edward Island, Volume 5, Part 1.

Table 7 - Distribution, by county, of farm machinery on Prince Edward Island, 1961.[1]

County	Autos	Motor Trucks	Tractors	Grain Combines	Threshing Machines	Hay Balers
Kings	854	728	1,113	88	297	201
Prince	1,867	1,099	2,130	254	705	338
Queens	1,992	1,426	2,470	302	654	508
Totals	4,713	3,253	5,713	644	1,656	1,047

[1]Modified from original table. 1961 Census of Canada, Agriculture, Prince Edward Island, Vol. 5, Part 1.

people off the Island's farms. The universal old age pension has permitted elderly people to leave their farms, and unemployment insurance benefits for fishermen during the off-season has led to less emphasis on farming for the farmer-fisherman (Raymond and Rayburn, 1963).

Forest is the natural climax vegetation on the Island and cleared land that is left idle will revert to woodland. Raymond and Rayburn (1963) have divided the transition from farm to forest into three stages: open grassland, scrub grassland and reforested land, and have given estimates of the areas of each in the province. Open grassland is the most recently abandoned farmland. The land is covered with old, uncut hay and weeds, and may have scattered bushes up to four feet high. The land-use survey of 1959 classified 60,720 acres (4.3 per cent of the Island's surface) as open grassland. Abandoned fields with scattered bushes over four feet high comprise the second stage, called scrub grassland. At the time of the survey there were 39,870 acres (2.9 per cent of the Island's surface) of scrub grassland. Reforested land is formerly cleared and cultivated land which has reverted to forest through natural seeding. From 1935 to 1959, 61,000 acres (4.4 per cent of the Island's surface) have reverted to forest (Raymond and Rayburn, 1963).

The best agricultural lands lie between Malpeque and Hillsborough Bays, where only 6.7 per cent of the land has been abandoned. In the western and eastern ends of the Island, respectively, 12.4 and 16.0 per cent of the farmland has been abandoned (Raymond and Rayburn, 1963). Concommitant with the general reduction in the area of land under cultivation there has been a reduction in the areas planted to specific crops (Figs. 3 and 4).

Biocides

Agricultural chemicals in extensive use include insecticides and herbicides. Of the former, D.D.T. was first used in Prince Edward Island in 1946. Before that, only inorganic pesticides such as calcium arsenate and lead arsenate were used to control insects in the province's cultivated crops. Since 1946 other organic insecticides such as aldrin, heptachlor, dithane, thiodan, malathion, rotenone, endrin and di-systron have been used on the Island. It is known that aldrin was introduced in 1956, and heptachlor in 1957. Thiodan, first introduced about 1953, was not used generally until 1959 or 1960. Some endrin was used in 1962, but to a very limited extent (F.M. Cannon, pers. comm.). The years that the other products were first used on the Island are unknown.

Potatoes are the main crop plant to receive treatment with insecticides. The insects that attack potatoes on Prince Edward Island are the Colorado potato beetle (Leptinotarsa decemlineata), the potato flea beetle (Epitrix cucumeris), and four species of aphids, the green peach aphid (Myzus persicae), the common potato aphid (Macrosiphum solanifolii), the buckthorn aphid (Aphis abbreviata), and the foxglove aphid (Myzus convolouli).

The Colorado potato beetle does most of its damage when in the early larval stage. Active larvae are abundant from the end of June to about July 10, during which period insecticides are applied in sprays and dusts. Though D.D.T. is the most widely used insecticide, thiodan, endrin, calcium arsenate, toxaphene and lead arsenate are also employed. Insecticides for the potato flea beetle are applied from mid-July to early September. Again, D.D.T. is the most common, with malathion, thiodan, endrin, and toxaphene employed less frequently. Aphids appear toward the end of July. D.D.T., malathion, or thiodan sprays are applied against them every ten days from early August to early September (F.M. Cannon, pers. comm.).

Aldrin and heptachlor are used to control the cabbage maggot (Hylemya brassicae). Because the maggots of the fly live in the soil close to the plant roots, it is

recommended that aldrin and heptachlor be placed in the soil at seeding time in a narrow band along each row. The material is commonly broadcast on the Island. This practice is facilitated by the packaging of aldrin mixed with inorganic fertilizers by at least one large distributor in Charlottetown. Aldrin has been packaged by the Island Fertilizer Company, Charlottetown, since 1956 (Table 8). Approximately 75 per cent of the packaged product is used on the Island. Aldrin is an effective poison in the soil for about six weeks.

Organic weed killers or herbicides have been used on Prince Edward Island since approximately 1946 (N. Black, pers. comm.). They are mostly applied to cereal crops, grass pastures, roadsides and railroad rights-of-way. Esters and amines of 2,4-D and methoxone sodium 48, (M.C.P.), are used to kill weeds in cereal crops and grass pastures. Weed killers are applied to grain fields when the grain is from six to eight inches high, usually between June 10th and July 15th (N. Black, pers. comm.). Roadsides and railroad rights-of-way are probably treated with 2,4-D, and 2,4,5-T.

Sodium arsenite has been used since the late 1940's on Prince Edward Island to kill potato tops. Since 1950 it has been the main top killer. The chemical is applied to approximately 10,000 acres of potatoes each year, at an average rate of about one gallon per acre (N. Black, pers. comm.).

Table 8 - Amount of aldrin packaged by Island Fertilizers Limited, Charlottetown, Prince Edward Island, 1956-1962.

Year	Amount Packaged (Tons)	Approx. Amount Used on P.E.I. (Tons)
1956	5.2875	3.9658
1957	6.0000	4.5000
1958	10.7080	8.0330
1959	8.0000	6.0000
1960	7.9615	5.9711
1961	9.2250	6.9187
1962	10.0000	7.5000

Eight manufacturers of agricultural biocides were asked what quantities of their products were sent annually to Prince Edward Island. Three companies provided data, but these were too fragmentary to be useful. No data on the distribution of biocides within the province or on the weed and shrub control practices along roadsides and railways could be obtained.

Cattle poisoning has been a problem on the Island since the early 1950's and has increased greatly since 1955, (Table 9). Approximately 50 per cent of the poisoning and 90 per cent of the mortality is due to arsenic compounds (H. Kelly , pers. comm.).

Other Chemicals

Sodium chloride has been used on ice and snow covered roads on Prince Edward Island since the winter of 1948-49. Prior to 1948, only sand was used on icy roads (Table 10). Until the winter of 1956-57 fluctuations in the amount of sodium chloride and sand used on the Island were not severe (Table 10). A sharp increase in the amounts of these two materials occurred during the winter of 1956-57. From 1957 the amounts of sodium chloride used slowly increased until 1960 when there was a sharp increase in the tonnage of salt dispersed (Table 10).

Table 9 - Numbers of calls made by veterinarians to diagnose poisoning of cattle on Prince Edward Island, 1951-1962.[1]

YEAR	MONTH												TOTAL
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1951	0	0	0	0	0	9	16	3	9	8	6	3	54
1952	2	0	0	2	1	0	11	1	3	5	2	3	30
1953	0	0	0	1	7	9	4	5	18	2	4	0	50
1954	4	3	1	0	5	6	10	11	6	10	2	2	60
1955	3	2	1	3	7	11	5	7	17	15	9	1	81
1956	0	0	1	6	7	20	30	11	26	47	18	3	169
1957	0	1	0	2	6	41	17	34	48	25	6	5	185
1958	0	1	0	2	8	23	30	20	19	19	5	0	127
1959	3	0	7	0	17	5	19	7	39	19	18	5	139
1960	2	8	10	3	5	32	31	21	70	48	4	10	244
1961	1	1	2	9	22	0	44	20	81	25	14	5	224
1962	2	0	0	4	2	18	27	11	5	32	6	4	111
TOTAL	17	16	22	32	87	174	244	151	341	255	94	41	1,474

[1] Compiled from Prince Edward Island, Department of Agriculture Annual Reports 1951-1962.

Table 10 - Materials and equipment used for road maintenance during winter, Prince Edward Island, 1945-1963.

Year	Salt (Tons)	Sand (Tons)	Sand Truck 2 Men Unit	Snowploughs Dept.	Snowploughs Contracted
1945-46		500	2		
46-47		500	3		3
47-48		500	5	22	4
48-49	60	500	5	24	4
49-50	100	700	6	27	4
50-51	100	700	6	39	3
51-52	100	800	6	42	-
52-53	80	800	6	44	-
53-54	200	800	6	44	2
54-55	100	800	8	46	-
55-56	160	2,000	12	49	6
56-57	600	8,000	25	58	8
57-58	560	12,000	30	70	12
58-59	685	15,000	35	80	15
59-60	820	20,000	46	86	20
60-61	1,540	25,000	47	91	25
61-62	1,430	30,000	48	98	32
62-63	2,500	unknown	54	102	35

Calcium chloride has been used on unpaved roads on the Island during summers for dust-settling and road-bed-hardening operations. The balance of each summer's supply has been used for dressing icy road surfaces in winter. No data on the amounts dispersed could be obtained, but an informant in the Department of Highways gave assurance that these were small (Department of Highways).

The Patridge and Pheasant

The Gray Patridge is native to Europe and the western U.S.S.R. The Ring-necked Pheasant is native to southern and southeastern U.S.S.R., Japan, Formosa, parts of mainland China and Mongolia, and neighbouring regions, but was introduced early and widely into Europe. Their excellent sporting and table qualities have led to the introduction of both species to many parts of the world.

Establishment in North America

Partridge were first introduced into North America in 1800 by Richard Bache, a son-in-law of Benjamin Franklin, and released near Beverly, New Jersey (Bent, 1932). The effort failed, as did other attempts to establish the species for more than one hundred years. More successful introductions were later made in all eastern states from Maine to Florida, mostly between 1905 and 1915. Some partridge survived a few years, but most stocks quickly died. Others were liberated in many western states, including California in 1877, Washington in 1897 (Yocom, 1943), Oregon in 1900 (Oldys, 1910), and Utah in 1911 (Porter, 1955).

One of the most successful introductions of partridge was made in Alberta in 1908 and 1909. Two hundred birds were released there, and within five years the population had multiplied and spread through Alberta and southern Saskatchewan.

According to Trippensee (1948), partridge are now established in British Columbia, Alberta, Saskatchewan, Manitoba, Washington, northern Oregon, western Idaho, northern Montana, North and South Dakota, southern Minnesota, northern Iowa, southwestern Indiana and northwestern Ohio. Self-maintaining local colonies are found in Pennsylvania, New York, New Jersey, Connecticut and Prince Edward Island. Trippensee failed to mention the populations in Ontario. In general the birds have been successful in regions where soil is fertile and domestic grains are grown intensively. The most northern areas with short summer seasons but soil sufficiently fertile to raise small grains and a good crop of weeds seem to be the most suitable type of environment. Dawson (1964) found success in Ontario correlated with agricultural practice, in particular with late mowing of the first hay crop. Extremely high summer temperatures have an adverse effect. Drought is not well endured. However, the exact factors that limit distribution are not always known. Low temperatures do not appear to limit the northward distribution of the partridge.

By the early 1930's approximately 270,000 partridge had been imported into North America at a cost of over a million dollars (Gordon, 1935).

Where the partridge did become established, it often spread widely. As a result, several provinces and states acquired populations of the birds without making separate introductions. Birds from Alberta drifted into Saskatchewan and Montana, from Saskatchewan into North Dakota, from Washington into Idaho, from Idaho and Nevada into Utah, from Manitoba and

Iowa into Minnesota, and even as far east as Ontario and Quebec (Edminster, 1954 and Porter, 1955). One of the best populations of partridge in Ontario occurs in the eastern part of the province around Chesterville and Winchester (Dawson, 1964).

The North American distribution of partridge, according to Aldrich and Duvall (1955), is shown in Figure 5.

A good account of the history of the pheasant in North America is given by Allen (1956). The first attempts to establish pheasants in North America were unsuccessful. These were by Governor Wentworth in New Hampshire and by Richard Bache on the Delaware River, in the last part of the 18th Century (McAtee, 1945).

The first successful pheasant introduction in North America was with the Chinese race (Phasianus colchicus torquatus) in the Williamette Valley, Oregon, in 1881. In 1892, a two and one-half month shooting season was opened and 50,000 pheasants were reported killed the first day.

More pheasant populations in the northwestern states spring from the successful Williamette Valley stock, from which many birds were trapped for distribution elsewhere. Few of the releases were recorded. Available records show that a few ring-necks were planted on Vancouver Island, British Columbia, in 1883 and in the lower Fraser Valley in 1890. Idaho received most of its pheasants from Williamette Valley prior to 1900. In 1909 the provincial government planted pheasants in British Columbia (Allen, 1956).

The earliest attempts to establish pheasants in California were by private release in the San Francisco area in the 1870's or 1880's. From 1889 to 1890 the California State Board of Commissioners planted some 850 pheasants. From 1908 to 1918, 4,183 locally raised pheasants were released. In all, more than a million pheasants were stocked up to 1955. Repeated stocking has been necessary to maintain pheasants in California owing to the periodic occurrence of unsuccessful breeding seasons.

The earliest authentic records of pheasant releases in the southwestern states are for Colorado in 1885, Utah in 1898, Oklahoma in 1909, Arizona in 1922, New Mexico in 1916, Nevada in 1917 and Texas in 1939. Populations were established in Utah and in Colorado. Despite repeated liberations, population increase has been slow in Nevada, Arizona, New Mexico and Oklahoma.

Prior to 1905, not more than 500 pheasants had been introduced into the northern prairie region of North America. They subsequently multiplied to such an extent that between 1940 and 1950 more than 82 million birds were harvested in North Dakota, South Dakota, Nebraska, Iowa and Minnesota. Pheasant releases in areas of suitable habitat have been successful in the Dakotas, Iowa, and Nebraska. Between 1925 and 1940 more than 18,000 adult birds were released and 100,000 eggs distributed to co-operating farmers in Kansas. In 1940 only 21 counties were opened for fall hunting but 47 counties were by 1950.

Between 1934 and 1951 the Government of Manitoba released about 5,000 birds. The Pheasant has not been entirely successful in Manitoba and the Province is still trying to establish a stable population. The species was introduced into Minnesota in 1905 with the release of 70 pairs from Wisconsin and Illinois. From 1915 until 1955 or 1956, a game farm had released more than 691,600 pheasants and distributed 96,578 eggs to sportsmen's clubs and farmers.

The introduction of the pheasant into Missouri was effected by furnishing game farm birds and eggs to co-operators.

About 1,000 birds were purchased and released in Nebraska. In 1926 and 1927, approximately 40,000 adult ring-necked pheasants were trapped and transplanted to various parts of the State. Pheasants are now shot everwhere in Nebraska.

The earliest introductions of pheasants in the Great Lakes region by state authorities, of which good records exist, are as follows: Indiana, 1908; Michigan, 1918; Ohio, 1919; Illinois, 1928; Wisconsin, 1929. Releases were made in Illinois as early as 1910, but no statistics were recorded.

The statistics shown below were compiled by the individual states between 1918 and 1953 on the numbers of birds released and chicks distributed. They are considered

of some value. They are no doubt incomplete, for not all programs were recorded.

	Wisconsin	Michigan	Illinois	Indiana	Ohio
Adults	970,975	242,018	455,724	510,541	744,823
Eggs and Chicks	3,680,120	872,136	1,114,369	1,766,916	497,376

Pheasants are now firmly established in all of the Great Lakes States.

The first pheasants were released in Ontario before 1892. Sporadic releasing of birds by private individuals and from a provincial pheasantry produced a population large enough to sustain a two week season by 1910 in the Point Pelee area and the Niagara Peninsula.

In Ontario, pheasants survive successfully only where the average annual snowfall is 50 inches or less.

In 1927, 36 Ring-necked Pheasants were released on Pelee Island in Lake Erie. By 1932 the population had grown to such proportions that there were complaints of crop damage by the birds, and the first resident hunting season was authorized in order to reduce the population. In 1934, non-residents also were permitted to hunt. Since 1931 the number of birds per acre has never been less than one, and at times has been as high as five.

According to the Colonial Laws of New York the first Ring-necked Pheasants were introduced into the Northeastern

states of North America in 1733. It was noted that during the term of Governor John Montgomerie ... "'about half a dozen couples of English Pheasants'" were released onto Nutten (now Governors) Island (Allen, 1956).

Several pairs of pheasants were released in New Hampshire in 1793, but were never seen again.

Stocking on Garner's Island off Long Island in 1892 and 1893 has resulted in a population of nearly 5,000 birds. During the early 1900's the species was established on Long Island. In western New York, 1,000 locally raised birds were distributed through many western counties of New York State. In 1903, 350 birds were released near Genesco, New York, and other birds were undoubtedly released subsequently. By 1905 the species was well established in western New York.

In 1887, after two unsuccessful releases, several pheasants were brought from England to a game farm at Allamuchy, New Jersey. Within a few years, they had established a wild population in the region.

During the early 1890's, private individuals released hundreds of pheasants in Pennsylvania. The practice continued up to 1915, when the Game Commission began raising them.

Pheasants were stocked in Massachusetts in the 1890's. By 1906 the bird was considered established and an open season was declared which was continued through 1907. The season was then closed until 1914.

Pheasants were introduced into New Hampshire in 1893. In 1896 the New Hampshire Fish and Game Commission began stocking them, with unknown success. The birds apparently prospered because a season was declared in 1915.

In 1897, five pairs of pheasants were liberated in Maine. They reproduced, but all the birds disappeared in the winter of 1899-1900. Later, pheasants were found to be spreading into Cumberland County, and after 1912, some were seen around Portland. By 1920 they were numerous in the Southern part of the state. The state continued releasing birds until, in 1931, pheasants had been liberated in all coastal and some inland counties.

The same pattern of private and state pheasant releases took place on Rhode Island. The private liberations began in 1894. In 1925 the state began a program of pheasant liberation which is now an annual, state-wide activity.

The only places where pheasants invariably produce good crops in the northeast part of the United States are the rich agricultural areas of New Jersey, Pennsylvania and New York.

Van Nostrand (1963) reported that, prior to 1930, several attempts were made to establish pheasants in Nova Scotia, none of which was very successful. However, releases made by a sportsmen's club in the Annapolis Valley in 1936, resulted in the establishment of a fairly large population. It slowly increased from 1936 to 1950 or 1951, when it reached its peak density. Thereafter it declined, slowly at first,

but more rapidly between 1954 and 1958. Van Nostrand (pers. comm.) has indicated that the population began to recover in 1963.

Following their successful introduction in the Annapolis Valley, hundreds of pheasants were liberated in many parts of Nova Scotia between 1951 and 1960. As a result, small pockets of birds became established. As in the Annapolis Valley, the initial populations expanded, and have since declined (Van Nostrand, 1963).

The North American distribution of pheasants, according to aldrich and Duvall (1955), is shown in Figure 6.

Ecological Requirements

Partridge appear to do best in a cool, moderately dry climate. The highest populations in North America are on the northern plains, where annual rainfall is between 15 and 25 inches, and humidity is moderate.

The best soils for partridge are highly fertile sandy loams, loams and loamy clays. Very heavy soils are less suitable. Gently rolling topography seems to suit the species best. Bare knolls and shallow depressions in open farm landscapes are preferred to either flat or hilly areas. Partridge may be found at altitudes as high as 5,100 feet in Washington, and below 100 feet on Prince Edward Island.

The most important cover types for partridge are crop fields and grassland; ..."no others are essential" (Edminster, 1954). Crop fields are most favoured when in

small grains and corn. Grasslands bearing grass or hay crops are more productive than those in pasture. Grain fields furnish year-round cover, though early nests are rarely found in them. Grain fields are the source of much food, including both grains and weed seeds.

Hayfields are perhaps used more than any other type of cover for nesting, except native grasslands where available. Roadside grass, fence rows of herbaceous or shrubby cover, pasture, and similar scattered or sparse grass covers make up the balance of nesting habitat. Fence rows furnish some nesting cover, at least where there is not much brush.

Woody cover is relatively unimportant to the species. Hedgerows may furnish shelter from the wind, as do haystacks, ditches and other obstacles. Partridges often use the field cover on the lea side of such protective areas rather than the shelter itself. Woodlands are of little use except for the edges, which may be used for nesting.

After hatching, the young spend much of their first weeks in uncut hay, grain, or other tall grass fields, where they feed on insects. In wet weather they are likely to move to grain and corn stubble. After the chicks learn to fly they spend more and more time in grain and corn fields. During hot weather they seek shelter in gullies and draws, or beside hedges, wood edges, and other wind-breaks, where such places occur close to field cover.

During the fall and winter seasons, partridge use open grain and corn fields, standing corn, weed fields and grasslands almost exclusively. "They have less need for protective shelter than any other of our northern game birds. At times they seek out places behind hedges, windbreaks, or other shelter to escape wintry winds, but otherwise they seem to try and stay in open, exposed places." (Edminster, 1954). Protection against wind under extreme conditions may be vital, and standing clover is said to provide excellent shelter (Hammond, 1941).

Adult partridge consume a variety of foods, many of which are byproducts of agriculture, including waste grain, weed seeds, and leaves of grasses and grain plants. Insects may make up some ten or fifteen per cent of the summer diet. Grains are most important in late autumn, winter, and early spring, and weeds seeds at all seasons except late spring and early summer. Green leaves are most important in late spring, summer, and early fall. These three items ordinarily make up 80 or 90 per cent of the entire diet (Trippensee, 1948).

A high proportion of the food taken by young chicks is insects, but the proportion declines with age as the bird becomes more vegetarian. In England, animal matter made up 95 per cent of the diet in the first week of life, 91 per cent in the second week, 52 per cent in the third week and three per cent in the fourth (Anon., 1939) (Table 11).

Table 11 - Foods consumed by adult partridge in England expressed in per cent by volume.[1]

Type of Food	Sept. 177 Crops	Oct.-Sept. 175 Crops	Dec.-Feb. 34 Crops	May-Mar. 12 Crops	June - Aug. 31 Crops	Av. 429 Crops
Grass, clover and leaves	9.9	26.5	68.0	92.2	14.3	42.2
Flowers and buds	0.9	0.2	-	6.0	28.7	7.2
Roots (sugar beets, etc.)	0.4	16.4	13.3	0.5	-	6.1
Seeds (grasses and weeds)	11.9	34.5	17.8	1.2	38.5	20.8
Grains (wheat, barley oats, and buckwheat)	76.3	22.4	0.7	0.1	6.5	21.2
Animal foods (mainly insects)	0.6	0.04	-	0.02	11.8	2.5

[1]Total percentages do not equal 100 in all cases. Data given as originally published (Anon., 1939).

When interpreting the Table it should be borne in mind that the English climate differs from that of P.E.I., being more warm and moist, with snow uncommon in winter. Succulent herbaceous growth is more abundant because a greater portion of the arable land is devoted to growing of cool-weather grains and root crops.

Running or standing water is not an essential element of the habitat (Yeatter, 1934). Partridge drink at water-holes on occasion during periods of drought, but appear able to satisfy their water requirements under normal conditions with dew and succulent herbaceous materials. Grit requirements are high all year around, and highest when the diet consists of grains. "In its grit requirements the Hungarian partridge far exceeds any other American gallinaceous bird" (Trippensee, 1948).

Cold, wet weather reduces the brood size of Ring-necked Pheasants. Usually cold and windy weather causes mortality even in mature and robust populations of adult birds. At the same time, the species is absent from hot, humid parts of the continent. It does best on fertile soil.

Pheasants use cover, for roosting, nesting, feeding, escaping from their enemies, and rearing their young. Cover for each need varies on different parts of the range as well as in relation to availability of food, the intensity of severe weather, and the number and nature of predators.

Cock pheasants establish their crowing territories in the period from late winter to midsummer. It is near these areas that hens make their nests. Crowing territory cover and nesting cover are therefore closely related and may be one and the same. Crowing territories must have cover

in which the cock can hide, and where food is adequate. Actually, an area divided by the cocks into crowing areas is usually merely good winter roosting cover broken into small units in such a way that each male has an area of his own reasonably close to a good feeding area (Trippensee, 1948).

Pheasants require good escape cover, provided, for example, by fence rows, woodland borders, swamp and marsh borders, kettle holes, and miscellaneous grass, weed and brush mixtures. In addition, there must be suitable and safe nesting cover for the hens when they occupy areas adjacent to the crowing territory.

Pheasants will nest in almost any vegetation that is tall and dense enough to cover the nest and its occupant. Hayfields, fence rows, hedgerows, grain fields, and orchards all provide attractive nesting cover, but not all provide safe cover. It is possible that wherever shrubby cover types occur near a crowing area, the prospects for successful incubation are enhanced, since the denser cover may attract females from hayfields and croplands, where nests are often destroyed by harvesting machinery (Trippensee, 1948).

In late summer and fall, pheasants forsake the brushy swamps and wooded areas where they have roosted during the winter for more open land, such as hayfields and herbaceous marshes. Early fall roosting cover differs little or not at all from summer cover. Winter frosts rarely seriously reduce

the cover along fence rows and in waste places, and the amount and variety are usually still adequate in spring. Late in the fall, the birds move into swamps and brushy areas in preparation for the winter.

Escape cover is vital to pheasants in evading natural predation and hunting pressure. A cover of dense shrubs may give protection from avian predators such as the Great Horned Owl and Cooper's Hawk, while swamps and marshy lands may provide sanctuary during the hunting season.

Food habits of pheasants are variable. However, certain generalities may be stated. Up until the age of three or four weeks the diet of pheasants is made up almost entirely of animal matter. After this age only about ten per cent of the food items are animal.

Dalke (1934) stated that pheasants could fare well with or without access to free water. He indicated that the birds were able to satisfy their water requirements with dew when other sources were lacking. It is possible that they could obtain sufficient moisture from grains, juicy fruits and succulent leaves.

Dalke (1938) found that the grit content of gizzards from young pheasants increased from 0.43 g. in week-old birds to a maximum of 3.08 g. in ten-week-old birds. For adults the amount of grit ranged from 5.50 g. in April to 2.2 g. in December. Average weight for the year was 3.39 g. The most common grits were granite, quartz and schists.

Establishment and decline of the upland game birds on Prince Edward Island

Partridge

The record of partridge releases in Prince Edward Island is believed complete. On October 29, 1927, ten pairs were liberated near a quarry on the Mount Edward Road just north of Charlottetown by J.D. Jenkins[1], D.A. McKinnon[1], W.K. Rogers[1], R.E. Mutch, Walter Grant, J.D. Webster, Percy Turner and others (Hurst, 1936). Morrison (1929) reported small flocks of partridge during the fall of 1928 at Highfield and Marshfield. At the time his report was written, (presumably the winter of 1929), he noted that a covey of more than 30 partridge had been seen on the east side of Charlottetown near the Peoples Cemetery and the golf links.

In the fall of 1931, the Prince Edward Island Government released 38 pairs of partridge (Peters, 1941), or 28 pairs (Acorn, 1954a). Six pairs were obtained, at a later date, from Saskatchewan (Peters, 1941). Acorn (1954a) and Peters (1941) agreed that, altogether, 59 pairs were brought to the province between 1929 and 1931. Neither the exact release points of the last 49 pairs, nor the age and condition of the birds was recorded. In spite of occasional set-backs, all apparently caused by severe winter weather conditions, the partridge became well established on Prince Edward Island, and the population continued to expand and increase for over twenty

[1]Now deceased

years after the first introductions. Successful breeding seasons were reported in 1929, 1930 and 1931. Morrison (1931) reported: "I visited every section of the Province during the year and the reports I received were encouraging. The Hungarian Partridges which were introduced into the province, are increasing rapidly."

The first set-back occurred in the winter of 1933-1934. J.S. Jenkins (pers. comm.) said that in November 1933, a crust of frozen slush formed on the ground, and prevented the birds from reaching food and grit. Subsequently cold weather kept the crust from melting for most of the winter. Peters (1941) stated that, in addition, many birds were killed by predators (species not named), and that possibly 80 per cent of the total population was lost. So little was known about the partridge population at that time, however, that the validity of the latter statement may be questionable.

Following the severe winter of 1933, partridge again multiplied, and soon became widespread in the province. Natural dispersal was aided by sporadic releases (Shaw, 1937). In 1937, a twelve-month open season was inadvertently created by the accidental omission of the species from the list of those protected under the Game

Act[1], an error that could not be rectified until the following year[2]. In 1939 the first open season was declared. Acorn (1954a) said that there were approximately 200,000 partridge on the Island in 1939.

Reports by Shaw (1940-1944) and Smith (1940-1942) state the condition of the partridge on Prince Edward Island over the next few years. In the winter of 1939-40, it was agreed that the population was healthy and increasing, but that severe conditions in the winter of 1940-41, and again the following year, caused definite decreases. An upswing was noted after the breeding season of 1942, followed by a succession of winter declines and successful breeding seasons until 1944, after which a gradual increase, without severe winter mortality, was reported until 1950 (Rodd, 1950). Acorn (1954b) indicated that partridge reached their greatest abundance in Prince Edward Island in 1948.

In the years following 1950, the number of partridge slowly declined (Jenkins, 1951). Rodd (1951) stated that of 53 hunting licensees who reported in 1951, 11 reported partridge as numerous as they were during the previous season, one that they were more numerous, 21 that they were less numerous, and 20 offered no opinion.

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[1]The Prince Edward Island Fish and Game Protection Act, 1937.
[2]An Act to amend "The Game Act, 1937".

The reports of Murnaghan (1953, 1957, 1959) showed that the partridge population of Prince Edward Island declined considerably in the 1950's. In 1953, he stated that the partridge covey size in 1952 was not as large as in other years. In 1957, he reported that the sale of non-resident hunting licences was down, and that the partridge population had decreased in 1955 and 1956. He again referred to the decline in sale of hunting licences in 1959, and said that, in spite of a 25 per cent reduction in bounties paid for predators from 1952 to 1957, which he felt indicated a decrease in the numbers of predatory animals on the Island, the birds continued to decrease in numbers. In view of the continued decline of the partridge population the species was put back on the protected list[1] in 1963.

Pheasants

The first introduction of pheasants into Prince Edward Island was made in 1917, when three pairs were brought from the Okanagan Valley, British Columbia. After their release, however, they failed to prosper, and all had died by 1919 (J.S. Jenkins, pers. comm.).

Robie W. Tufts is quoted in Godfrey's account of Prince Edward Island birds (1953) as follows: "There were two attempts at introducing the Ring-necked Pheasant into Prince Edward Island in 1925. In the spring of that year

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[1]The Fish and Game Protection Act Regulations, July 4, 1963, Charlottetown, Prince Edward Island.

four hens and one cock were liberated at Charlottetown while at Vernon River, about fourteen miles from Charlottetown (east) 'a few pairs' were liberated at the same time. During the summer of 1925 three coveys were reported near Vernon River. Though there has not been any appreciable increase noted to date (1927), they are still present in small numbers and are frequently reported as seen in rural districts."

J.S. Jenkins (pers. comm.) stated that some of the first cock pheasants to be released on the Island still survived in 1929.

F. Acorn (pers. comm.) and Dr. Hector MacKenzie liberated a number of pheasants from their own stock between 1935 and 1939. Shaw (1937) stated, "Hatching of ring-neck (sic) pheasant eggs, and also a number of birds were imported and distributed to various points on the Island", which seems to indicate that birds had been imported for an indefinite period. In 1938, Shaw expressed doubt that any of the imported pheasants had survived. In 1940, approximately 50 more pheasants were released in the Tea Hill and Keppoch areas (F.A.S. Jones, pers. comm.). According to Jones, 141 pheasants were hatched and released at Charlottetown in 1941. Acorn (1955) reported that in 1942, 126 pheasants were

hatched at the Dominion Experimental Farm at Charlottetown. They were liberated when about eight weeks old. The release areas were not recorded. Shaw (1942) and Jenkins (1942) both indicated that approximately 50 pheasants had been seen south of the Hillsborough River around Southport in the spring of 1942. F. Acorn (pers. comm.) said that these were from the Experimental Farm Release.

In 1946 an organization called "Island Pheasants Unlimited" released 354 (Acorn, 1946) or 250 (Acorn, 1955) pheasants in scattered areas of the province. Shaw (1946) reported that Island Pheasants Unlimited released 615 pheasants during 1945 and 1946, and by the latter year, pheasants had apparently spread well into Kings County and as far east as South Lake and East Point (Anon., 1946). It seems likely that the pheasants released in 1942 had successful breeding seasons from 1942 to 1946.

The pheasant population of P.E.I. continued to increase in numbers from 1946 to 1956. In 1947 the first open shooting season was declared. Five hundred adult pheasants were released in March 1948 (Acorn, 1954a). Jones (1948) reported that pheasants appeared "spotty" in 1948, due to the fact that ..."they are hard to check as they inhabit swamps, alders, etc.". Rodd (1950) considered

pheasants plentiful enough in 1950 to sustain an open season. Jenkins (1951) indicated that the birds increased in number between 1950 and 1951, with good pheasant shooting reported in most sections of Kings and Queens Counties and in Prince County east of Miscouche swamp; none was said to occur west of a point three miles west of Miscouche. In 1951 Jenkins reported that 249 resident hunters shot 381 pheasants.

After 1954, the best year for pheasant shooting according to Acorn (1954a), the numbers of birds began to decrease slowly. A stocking program was undertaken by the Prince Edward Island Fish and Game Association in an effort to counteract the decline. In 1956, approximately 3,203 pheasants were released, and 821 in 1957. Several hundred more pheasants, destined for release in 1957, had to be destroyed due to an outbreak of Salmonella (paratyphoid) in the hatchery where they were housed. In 1958 a number of birds were released, but the total is not known.

Jenkins (1959) said that 300 pheasants had been received in April 1959, and that they had been divided into three groups, 120 for Prince County, 120 for Kings County and 60 for Queens County. He added that some time later 37 birds were obtained locally (on the Island), and released

in Queens County. He indicated that the Kings County birds were released immediately, though both there and in Queens County some were kept for breeding purposes. The 600 eggs obtained from these latter birds were distributed to farmers to be hatched under domestic hens. In July 1959, 51 more pheasants were released in Prince County. It is interesting to note that Jenkins (1959) later reported that only 165 birds had been received and that these had been divided equally between the three counties. P.A. Murnaghan (pers. comm.) stated that this latter shipment included 175 birds.

In spite of the stocking program, the pheasant population continued to diminish, and in 1963, the species was placed on the protected list[1].

The former distribution of pheasants in Prince Edward Island is indicated in Figure 7.

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[1]The Fish and Game Protection Act Regulations, July 4, 1963, Charlottetown, Prince Edward Island.

Factors of possible importance in the decline of upland game birds

Habitat

The fact that Gray Partridge found good habitat throughout Prince Edward Island, was undoubtedly a factor in the rapid establishment of the species throughout the Island and the maintenance of a high population for more than 20 years. It is probable, however that the Ring-necked Pheasant, for several reasons, did not find the habitat as favourable as did the partridge. The pheasant is typically a farm inhabiting species, and may have found the "clean" farms of the Island deficient in cover. In eastern Queens and western Kings counties, where pheasants survived for several years, the farmers keep their fence rows reasonably clear, and clean up their fields after harvesting their crops. Possibly, then a lack of cover on the Island's farms limited the pheasant population.

It is possible that the increase in the number of tractors and mowers (Table 6) during recent years has increased the number of birds killed during haying operations. When partridge and pheasant were numerous farmers indicated that they encountered them in hay fields during the mowing season.

Queens County has the most grain and hay crops of the three Prince Edward Island counties (Table 12).

Table 12 - Total acres of hay and grain crops for Prince Edward Island by county - 1961.

	Prince	Queens	Kings
Hay	69,019	75,942	33,603
Grain	60,174	71,746	28,077

The total number of acres under cultivation on Prince Edward Island has decreased in recent years (Figure 3). A decrease in total grain crops, coupled with more efficient harvesting with combines, may also have contributed to a decline in the number of upland game birds, particularly pheasant.

In some parts of the province farms have been abandoned at a steady rate for several years. It is possible that the early grassland stage through which succession on the abandoned fields proceeds, provides desirable food and cover for upland game. These conditions are eliminated by later successional stages. There is no evidence, however, that the early grassland stage now occupies a lesser area than it did during periods of upland game abundance.

The central hills may have prevented the natural dispersal of pheasants westward (Figure 7). The poor success of at least 15 attempts to stock pheasants in eastern Prince and western Queens Counties, and 15 more attempts in western Prince County, suggests that the habitat there was unsuitable, and two factors may be suspected. In western Queens and eastern Prince Counties intensive agriculture is practiced, which may practically have eliminated the cover that is necessary for pheasants (see land use maps). In western Prince County the fact

that farms are, in general, not as clean nor as intensively cultivated as in Queens County indicates that perhaps land was not adequately cleared for pheasants. There are, however, well-cleared farms in a number of areas, for example, around O'Leary and West Point where pheasants were successful.

Although changes in habitat and in agricultural practice alone were probably not responsible for the sharp decline in the numbers of upland game birds on the Island, it is suggested that they may have contributed somewhat to the decline.

Soil

During the past 30 years several writers have suggested that the calcium content of soil may significantly influence the distribution of pheasants in North America. Leopold (1931) pointed out the success of pheasants released on the most recently glaciated, calcium-rich soils of the north central states and the failure of birds released on old glacial or unglaciated deposits (Greeley, 1962). Leopold contends that "... it is possible the fresh glacial deposits contain lime or grit of a quantity or quality necessary to the welfare of these birds".

Leopold's claims have been somewhat substantiated. Dale (1954, 1955) demonstrated a high correlation between the abundance of the pheasant and availability of this element. He also tested the effects of limestone provided as grit in connection with an experimental diet and showed that pheasants on a diet comparable to that received by the pheasant in the wild reproduced when given limestone grit, but failed on the same diet when supplied with quartz grit. He concluded that pheasants would be unable to survive and reproduce on a diet of corn and small grains without some kind of calcium supplement either in grit or soil. Dale and DeWitt (1958) showed that it was necessary to provide 600 mg. of calcium and 385 mg. per kg. per day of phosphorus to obtain satisfactory production of eggs and young. Greeley (1962) found reductions in the rate of egg production, the amount of ash in the leg bones, and the thickness of egg shells at 1.09 per cent, and less, of calcium in the diet; egg size and bone weight declined to a lesser extent. He noted that hens which produced few eggs on a low-calcium diet lost more weight than hens which produced many eggs on a high-calcium diet. Greeley's (1962) data indicated that the bone-ash content and eggshell thickness of wild hens from thriving populations in central Illinois were equivalent to

those found in the experimental hens with two per cent, or more, of calcium in their diets, indicating a positive calcium balance in the wild hens.

Dale and DeWitt (1958) showed that prolonged calcium deficiency has adverse cumulative effects.

In view of the above evidence it is possible that the low calcium content of soils on Prince Edward Island had detrimental effects on Ring-necked Pheasants and their reproduction. However, no measure of the significance of these effects could be obtained. It is suggested that calcium deficiencies may have helped to hold the pheasant population in check, but did not contribute substantially to the sudden decline in numbers of those birds. It is apparent from their reproductive success that Gray Partridge were unaffected by the low calcium content of the soil.

Disease

In 1957, several hundred young upland game birds had to be destroyed because of an outbreak of Salmonella (paratyphoid) in the hatchery in which they were housed (J.S. Jenkins, pers. comm.). There are no other cases of veterinary examination of game birds on record for Prince Edward Island.

There are also few records of poultry disease. R.S. MacDonald (pers. comm.) believes that avian tuberculosis

is becoming more common, though records made before 1961 are not available. Tuberculosis far exceeded other causes for condemnation of poultry carcasses at one processing plant in the Province (Table 13).

Pullorum disease (Salmonella pullorum) is of no importance on Prince Edward Island (Table 14). Although records are lacking, MacDonald said that Newcastle disease and blackhead (Histomonas meleagridis) have had negligible effects on the Island's domestic poultry flocks.

Predators

Because no studies on the relation between predators and upland game birds on Prince Edward Island have been carried out and because no data are available on the size of the predator populations, the damage there to partridge and pheasant cannot be directly measured. Only vague inferences as to the possible extent of predation can be based on the information available, i.e. the number of animals presented for bounty payments.

The skunk (Mephitis mephitis) was introduced into Prince Edward Island in 1917 and increased rapidly in numbers. In 1932, the province began to pay a $0.50 bounty on it. In the same year, a $1.00 bounty was offered for the Snowy Owl (Nyctea nyctea), and presumably also for the Great Horned Owl (Bubo virginianus). From April 26, 1940, to September 19,

Table 13 - Diagnosed disease in domestic poultry for 1961-62.[1]

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1961													
No. of Chickens killed	0	0	0	9,437	13,621	3,654	2,601	18,904	15,229	5,123	9,422	2,515	81,506
No. of cases tuber-culosis	0	0	0	26	68	93	116	1,024	912	129	637	94	3,099
Per cent	0	0	0	0.28	0.49	2.54	4.46	0.51	0.59	2.52	6.76	3.73	3.8
No of cases leucosis	0	0	0	0	0	0	0	0	2	0	0	2	4
per cent	0	0	0	0	0	0	0	0	0.013	0	0	0.795	.0049
No. of cases neoplasm, emaciation	0	0	0	17	24	3	0	23	20	7	26	11	131
Per cent	0	0	0	0.18	0.18	0.82	0	0.12	0.13	0.14	0.28	0.43	0.16
1962													
No. of Chickens killed	3,408	0	0	0	3,242	4,707	10,340	3,568	13,585	6,957	10,967	2,216	58,990
No. of cases tuber-culosis	41	0	0	0	61	120	268	5	388	393	330	27	1,633
Per cent	1.2	0	0	0	1.88	2.55	2.59	0.14	2.86	5.65	3.01	1.22	2.75

Table 13 - (Continued)

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1962													
No. of cases of leucosis	0	0	0	0	0	0	11	1	0	0	0	0	12
Per cent	0	0	0	0	0	0	0.001	0.0073	0	0	0	0	0.020
No. of cases emaciation neophasm	17	0	0	0	36	54	20	0	84	41	10	10	242
Per cent	0.49	0	0	0	1.11	0.51	0.19	0	0.62	0.59	.091	0.45	0.41

1 Data compiled from condemnation slips, Canada Department of Agriculture for Jenkins Processing Plant, Summerside, Prince Edward Island.

Table 14 - Number of birds tested for pullorum and the number of reactors.[1]

Year	No. of Birds Tested[2]	No. of Reactors
1963	7,758	Nil
1962	24,755	Nil
1961	13,739[3]	235
1960	34,900[3]	1
1959	41,120[3]	1
1958	38,412[3]	14
1957	14,292[3]	17
1956	38,172[3]	63
1955	27,972	Nil
1954	32,526	Nil
1953	6,628[3]	3
1952	22,999	Nil
1951	29,718	Nil
1950	28,863[3]	2
1949	26,647	Nil
1948	29,681	Nil
1947	29,762[3]	39
1946	36,241[3]	36
1945	37,209[3]	230
1944	50,122[3]	149

Table 14 -(continued)

Year	No. of Birds Tested [2]	No. of Reactors
1943	40,845[3]	94
1942	31,579[3]	54
TOTAL	640,940[3]	938

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1 Data compiled from blood testing reports of the Poultry Division Marketing and Production, Canada, Department of Agriculture, for Prince Edward Island.

2 Only chickens to be used to supply eggs to hatcheries are tested for pullorum.

3 Only flocks with reactors are retested. Therefore, these flocks contain a certain number of birds which were tested at least twice.

1941, no bounty was offered on skunk. On September 20, 1941, the skunk bounty was restored and on October 3, 1942, it was raised to $1.00 (Peters, 1943). Because no data on owls are available for the period after 1945, it is assumed that the owl bounties were stopped at that time.

Bounty payments were authorized in 1951 as follows: red fox - $2.00, Crow (Corvus brachyrhyncus) and Raven (Corvus corax) - $0.15. In 1953, the raccoon (Procyon lotor) was added to the list at $2.00.

Bounty returns have varied from year to year since 1932 (Table 15). However, in total, there has been no pronounced increase or decrease in the number of predators presented for bounty (Figures 8-12). Owls appear to have fluctuated strongly, but data were not available for the critical years. Because data for 1946, 1947, 1949, and 1950 were not available, the trends for skunks had to be calculated in two groups. In general, it is evident that the number of predators on Prince Edward Island has not been noticeably effected by the inducement of bounty payments.

Minor or short-term trends in the figures are sometimes possible to explain. In 1942, 202 owls were offered for bounty, the large number being attributed to a Snowy Owl invasion (Peters, 1942). In the same year, 9,763 skunk snouts were offered for payment, a peak created, it is suspected, by the suspension of the bounty payment on skunks

the previous year, and a consequent storing of skunk snouts in the expectation that it would be reinstated. The catch of 1943, 5,987, was also unusually high, and the reason may well be found in the addition of fifty cents to the skunk bounty that year. The 1944 catch, of 4,012 skunks, showed a return to more normal conditions.

Another peak in the number of skunks presented for bounty was in 1951, when 7,491 were recorded. It seems likely, however, that the peak indicates only an increase in hunting and trapping, brought about by the addition of the fox, crow and raven to the list of species on which bounties were to be paid. The next year, skunks were taken in more usual numbers, and it may be assumed that the interest aroused by the additions to the bounty list was over. Similarly, a peak in the number of foxes presented annually for bounty payment, occurring in 1955, may be explained by an increase in the payment, from two to three dollars, which took place for a period during that year (J.S. Jenkins, pers. comm.).

There has been no marked change in abundance of avian or mammalian predators, on Prince Edward Island, and no evidence that predators could have been responsible for the decline in upland game birds.

Table 15 - Number of animals and birds for bounties, and the total expenditure for bounties and their administration, 1932-1963.

Fiscal Year	Expenditure	ANIMALS				
		Owls	Skunks	Foxes	Raccoons	Crows
1932	$3,640.55	14	5,561			
1933	3,721.30	62	5,643			
1934	2,305.55	74	3,838			
1935	2,008.95	143	3,114			
1936	2,175.45	110	3,474			
1937	3,309.20	132	3,064			
1938	1,970.65	144	3,117			
1939	1,985.50	106	3,298			
1940	670.00	54	586			
1941	1,149.75		2,168			
1942	7,302.88	202	9,763			
1943	7,125.51	94	5,987			
1944	4,415.86	43	4,012			
1945	5,848.29	6	825			
1946	6,621.90		Unknown			
1947	5,591.35		Unknown			
1948	2,934.10		2,396			
1949	4,289.09		unknown			
1950	11,551.17		unknown			

Table 15 - (continued)

Fiscal Year	Expenditure	ANIMALS				
		Owls	Skunks	Foxes	Raccoons	Crows
1951	$7,556.62		7,491	924		793
1952	unknown		4,395	1,543		1,067
1953	unknown		2,924	1,832	323	743
1954	11,049.00		4,407	2,005	460	2,320
1955	23,615.00		5,643	3,352	1,163	1,900
1956	20,459.00		4,388	1,588	1,462	2,060
1957	17,509.26		4,314	2,039	1,471	2,573
1958	15,582.07		4,530	2,032	939	1,592
1959	14,669.71		3,832	1,525	665	1,418
1960	16,423.89		5,557	1,821	1,102	1,090
1961	15,317.10		4,993	1,379	561	397
1962	13,464.57		3,906	2,295	782	1,061
1963	19,182.75		5,834	2,378	1,005	1,028

Biocides

Adult Gray Partridge and Ring-necked Pheasants feed sparingly on animal matter, which generally comprises only some ten per cent of their total intake (Johnson, 1930; Hicks, 1936; Dalke, 1934; Yeatter, 1934; Middleton and Chitty, 1937). The chicks, on the other hand, for three or four weeks after hatching, choose a diet which may be 95 or 98 per cent animal matter (Kelso, 1932; Dalke, 1934; Anon., 1939; Loughrey, 1951).

The peak hatching dates for Prince Edward Island partridge and pheasant are unknown, but available data from other regions suggest that the partridge hatch between June 5 and June 20 and the pheasant between June 1st and June 15th (Yocom, 1943; Knott, Ball and Yocom, 1943; Porter, 1955).

Dates on which biocides are applied to crops on Prince Edward Island vary slightly from year to year, but generally fall within the limits shown in Table 16.

It is apparent that as many biocides are applied to field crops when juvenile game birds are eating insects as when the birds have switched to a plant diet. It is probable, therefore, that birds consume contaminated foods and come in contact with contaminated vegetation. Though it is not definitely known, it may be supposed that some are killed or impaired by agricultural chemicals.

Table 16 - Approximate dates of application of biocides and the pests for which they are applied on Prince Edward Island.

Biocide	Pest	Approximate Date of Application.
Aldrin	Cabbage maggot	May 15th to June 10th
2-4D	Weeds in grain	June 10th to July 15th
MCP	Weeds in general	June 25 to July 31
DDT Thiodan Rotenone Toxophene Calcium arsenite Lead arsenate	Colorado potato beetle Potato flea beetle Potato aphids	June 15th to July 10th June 25th to Sept. 5th July 15th to Sept. 5th
Sodium arsenite	Late blight of potatoes	Sept. 1st to first killing frost

It has been suggested that the agricultural use of sodium arsenite has been responsible for the death of many game birds. At the time that sodium arsenite is applied to potato fields, all insects for which control measures have been used have completed their life cycles and retired below the soil. At the same time, upland game birds are no longer eating insects and other animal life. Because of intense cultivation there are few weeds, and therefore, few weed seeds, in potato fields at the time of application of sodium arsenite. Therefore, if partridge and pheasant are found in potato fields in September and October, they are probably not there to gather food, and it seems unlikely that they would ingest the poison, except, perhaps, while preening.

Reports that biocides were responsible for the deaths of large numbers of partridge and pheasant could not be verified. It seemed possible, however, that biocides did kill some game birds, or impair them reproductively and otherwise, but the extent of such damage, or significance of biocides in limiting numbers of game birds, was unknown.

Sodium chloride and calcium chloride

It has been established, through experimental feeding, that an excess of salt in the feed is toxic to domestic fowl and may cause death (Barger, Card and Pomeroy, 1958), but also that both chicks and older fowl can tolerate rather high salt concentrations in their diets. Mitchell, Card and Carman

(1926) found that chickens could be raised from nine to twenty-one weeks of age on rations containing as high as eight per cent of salt with no apparent detrimental effects. Quigley and Waite (1932) showed that young chicks were able to endure salt levels as high as 30 per cent for short periods of time, and that it was impossible to place enough salt in an all-mash ration to produce an appreciable amount of sudden mortality. The unpalatibility of feed containing large quantities of salt and the tendency to consume large quantities of water when fed a salty ration appear to protect the birds against an overdose under natural conditions.

Barlow, Slinger and Zimmer (1948) found three per cent added salt to be the minimum toxic level in chicks under nine weeks of age. The heaviest mortality occurred during the first month after hatching.

Barger, Card and Pomeroy (1948) pointed out that salt in drinking water is much more toxic than that given in feed.

At the time that calcium chloride is spread on road-surfaces in P.E.I. in dust-settling operations in the summer, there is no reason for partridge or pheasant chicks to frequent roadsides to pick up grit. By the time that sodium chloride is applied to icy roads in the winter all birds of the year have reached

the adult or near-adult stage. At this time their tolerance for salt in the diet is probably very high. Therefore any salt particles picked up by game birds while picking grit probably does little damage to the birds. As pointed out, the unpalatibility of the chemical probably precludes consumption of large amounts. As has been indicated, partridge and pheasants can survive without access to free water. Therefore there is little probability that those birds would drink from salty pools of water resulting from the action of salt on ice.

Reports that salts on road surfaces were causing the deaths of large numbers of partridge and pheasants could not be confirmed. It is possible, however, that salts may have killed some birds. The degree of damage caused could not be ascertained but was considered extremely small.

Shooting

Angling and hunting licences for Prince Edward Island were first issued in 1941. From 1941 to 1949 the Department of Agriculture administered the sale of licences. Unfortunately, the categories under which permits were issued were not kept constant and it was therefore not possible to calculate the number of resident and non-resident licences sold. The numbers and names of licences issued are shown in Table 17. Unfortunately, it was impossible to find out exactly what each permitted.

Table 17 - Angling and hunting licences issued for Prince Edward Island, 1941-49, from Prince Edward Island Department of Agriculture Annual Reports. Where not specified licences are believed to have permitted both angling and hunting.

1941	Resident fishing licences	- 1,476
	Non-resident licences	- 336
	Hunting licences	- 8
1942	Resident licences	- 1,513
	Non-resident licences	- 94
	Number of angling and hunting licences issued unknown	
1943	Resident licences	- 1,198
	Non-resident licences	- 81
1944	Resident licences	- 1,071
	Non-resident licences	- 86
1945	Resident	- 1,491
	Non-resident	- 98
	Hunting	- 2
1946	Resident	- 1,795
	Non-resident	- 342
	Hunting	- 23
1947	Resident	- 2,417
	Non-resident	- 712
	Hunting	- 7
	Hunting	- 21
1948	Resident fishing and hunting	- 2,919
	Non-resident fishing	- 783
	Non-resident hunting (a $10.00)	- 61
	Non-resident hunting (a $25.00)	- 3
	Non-resident hunting (a $35.00)	- 14
1949	Resident hunting and fishing	- 3,068
	Non-resident fishing	- 783
	Non-resident four day hunting	- 61
	Non-resident hunting	- 3
	Non-resident hunting (other)	- 14

From 1950 on, the sale of game licences was controlled by the Department of Industry and Natural Resources, and during this period the permit categories remained static (Table 18). There is a discrepancy between the figures of the two Departments for 1949.

Hunting seasons and bag limits for partridge and pheasant were first enacted in 1938. The first open hunting season for partridge was declared in 1938, but the dates and bag limits set were not recorded for the seasons up to 1946 (Government of Prince Edward Island, Office of the Provincial Secretary, pers. comm.).

In 1947 the first open hunting season for Ring-necked Pheasant was declared but, as was the case for partridge, the season dates and daily bag limit were unknown (Government of Prince Edward Island, Office of the Provincial Secretary, per. comm.) In 1947, the Greater Prairie Chicken (Tympanuchus cupido) was added to the protected list and in 1948 Chukher Partridge [sic] (Alectoris graeca) and quail (presumably Bob-white Quail - Colinus virginianus) were protected by law. Nothing was known of the hunting seasons and daily bag limits for the upland game birds in 1948, 1949, or 1950.

The regulations for partridge, pheasant and Ruffed Grouse are known from 1951 to 1962 (Table 19).

It was apparent from the fact that good hunting was enjoyed while both Gray Partridge and Ring-necked Pheasants were increasing, that this factor did not bring about an abrupt decrease in their number. It is possible however, that following the decrease in the numbers of birds, hunting may have become a limiting factor. This suggestion could not be verified.

Climate

There is good evidence that the climate of Prince Edward Island is generally unfavourable to the pheasant, and occasionally so to the partridge.

A method of wide application in judging the compatability of an exotic species and its prospective home is climatic comparison by means of "climographs" (Twomey, 1936; Bump, 1963). In comparing, by means of a climograph (Figure 13) the temperature-precipitation relationships of mid-European Gray Partridge range with those of Prince Edward Island; it is evident that the nesting season on Prince Edward Island falls within the climatic limits of good European range, though at other times during the year there are noticeable divergences.

The months of January, February and March appear to be the most critical for the partridge and pheasant of Prince Edward Island. Deep snow and low temperature, as, for example, were experienced in the winter of 1947-48 (Figure 14) apparently kill neither partridge nor pheasant in any appreciable number. Freezing rain on vegetation and crusting snow, however, appear to be a serious menace. On January 23, 1957, 0.47 inches of freezing rain fell on 10.0 inches of accumulated snow at Charlottetown and 0.65 inches of freezing rain fell on 1.0 inches of snow at Summerside. Following the freezing rain of January 23, the daily maximum temperature did not rise above freezing until February 3 at Summerside, and February 4 at Charlottetown. Later in February,

25 inches of snow accumulated at Charlottetown, and 27 inches at Summerside (Figures 15, 16). It was probable that the one-half inch of freezing rain thoroughly coated vegetation and caused a heavy crust on the snow, and that the conditions thus created prevailed for ten days or more due to persistently low temperatures. It seems reasonable to suppose that between January 23 and February 4, 1957, the major portions of the partridge and pheasant populations were killed because their food and shelter were covered with ice and crusted snow. Deep snows in the latter part of February of the same year may have destroyed additional weakened survivors. It was clear from reports that the first major reduction in partridge and pheasant numbers followed the winter of 1956-57.

During January, 1961, 16.0 inches of snow accumulated at Charlottetown, and 27.0 inches at Summerside. On January 16, 0.5 inches of freezing rain fell on 12.00 inches of snow at Charlottetown, and 0.1 inches of freezing rain fell on 12.0 inches of snow at Summerside. Two days later the temperature fell below freezing and remained there 31 days. On January 20, at Summerside, 19.8 inches of snow fell and by winds gusted to 89 mph. Winds from 24 to 39 mph continued for at least 11 days. Snow depth rose to 15.0 at Charlottetown and remained at that height until February 10, when it rose again. In March snow depth reached 32.0 inches at Charlottetown and 23.0 inches at Summerside and remained at that depth until the end of April 1961 (Figures 17, 18).

Table 18 - Angling and hunting licences issued for Prince Edward Island, 1949-62, from Prince Edward Island Department of Industry and Natural Resources. The cheaper non-resident hunting licence was for residents of Nova Scotia and New Brunswick only.

Season	Resident Angling	Non-Resident Angling	Resident Hunting	Non-Resident Hunting			Revenue
				$25.00	$35.00	Total	
1949	3,552	907	-	-	-	77	8,462.35
1950	3,746	1,165	-	20	109	129	10,386.35
1951	4,251	1,086	-	15	132	147	12,473.25
1952	4,952	1,158	-	17	97	114	12,252.25
1953	5,467	1,159	-	10	84	94	12,138.50
1954	5,222	1,209	-	22	96	118	12,833.50
1955	5,291	1,238	-	18	130	148	14,009.50
1956	5,298	1,571	2,591	26	92	118	16,476.50
1957	4,989	1,596	2,506	20	57	77	14,782.50
1958	6,884	1,941	2,924	17	48	65	17,741.75
1959	7,265	1,965	3,283	15	32	47	17,938.00
1960	6,987	1,705	3,498	13	22	37	16,695.00
1961	6,570	1,704	3,444	10	11	21	15,761.00
1962	7,681	1,834	3,386	6	8	14	16,999.00

Table 19- Upland game bird seasons and daily bag limits, Prince Edward Island, 1951-63, from Prince Edward Island Department of Industry and Natural Resources.

Date	Hungarian Partridge	Bag Limit	Pheasants	Bag Limit	Ruffed Grouse or Native Partridge	Bag Limit
1951	Oct. 1 - Nov. 11	8/day	Oct. 1 - Nov. 11	2 cock birds per day	Oct. 15 - Oct. 31	3/day
1952	Oct. 1 - Nov. 11	8/day	Oct. 1 - Nov. 11	3 cock birds per day	Oct. 15 - Oct. 31	3/day
1953	Oct. 10 - Nov. 20	8/day	Oct. 10 - Nov. 20	3 cock birds per day	Oct. 15 - Oct. 31	3/day
1954	Oct. 9 - Nov. 19	8/day	Oct. 9 - Nov. 19	3 cock birds per day	Oct. 15 - Oct. 31	3/day
1955	Oct. 1 - Nov. 11	8/day	Oct. 1 - Nov. 11	5 birds per day	Oct. 15 - Oct. 31	3/day
1956	Oct. 1 - Nov. 11	8/day	Oct. 1 - Nov. 11	5 per day in Kings and Queens only	Oct. 15 - Oct. 31	3/day
1957	Oct. 1 - Nov. 11	5/day	Oct. 1 - Nov. 11	3 per day including not more than 1 hen in Counties K.Q. & P. east of S side	Oct. 15 - Oct. 31	3/day
1958	Oct. 1 - Nov. 11	5/day	Oct. 1 - Nov. 11	3 per day (same as above)	Oct. 15 - Oct. 31	3/day

Table 19 - (Continued)

Date	Hungarian Partridge	Bag Limit	Pheasants	Bag Limit	Ruffed Grouse or Native Partridge	Bag Limit
1959	Oct. 1 - Nov. 11	5/day	Oct. 1 - Nov. 11	3 per day (same as above)	Oct. 15 - Oct. 31	3/day
1960	Oct. 1 - Nov. 11	5/day	Oct. 1 - Nov. 11	3 per day (same as above)	Oct. 15 - Oct. 31	3/day
1961	Oct. 2 - Nov. 11	5/day	Oct. 2 - Nov. 11	3 per day (same as above)	Oct. 2 - Nov. 11	3/day
1962	Oct. 22 - Nov. 3	5/day	Oct. 22 - Nov. 3	3 (including 1 hen)	Oct. 1 - Nov. 10	3/day
1963	Closed		Closed		Oct. 1 - Nov. 11	3/day

As was the case in 1957, the crust created by freezing rain and deep snows probably covered food and shelter again in January 1961, and so caused a further decline in the population. Continued deep snows during March and April of 1961 may have reduced the number of survivors. According to reports, the winter of 1960-61 was another period of decline in the numbers of upland birds.

It thus seems likely that freezing rain during the winter of 1957 was responsible for the destruction of a large segment of the upland game bird population. The reduced population failed to recover sufficiently to withstand the winter of 1961, and at that time the population was again reduced by a similar climatic event.

SUMMARY

The most important factors and their probable effects on the population dynamics of the Gray Partridge and the Ring-necked Pheasant on Prince Edward Island are discussed in the following summary. The importance of those factors have been assigned subjective values and are shown in Table 20.

1. Predation

There seemed to be no evidence that predatory mammals and birds of the province could have caused the decrease in the numbers of partridge and pheasant.

2. Disease

There was no evidence that disease alone ever caused a heavy reduction in, nor currently constitutes a major limiting factor on, the number of upland game birds on Prince Edward Island.

3. Shooting

Licence returns suggested that shooting by itself was not the sole cause for the decrease in upland game bird numbers.

4. Chemicals

(a) Biocides

It seemed reasonable to suppose that biocides have killed, and may continue to kill, upland game birds. These

chemicals may also have reduced the fecundity of individual birds. There was no evidence to suggest, however, that biocides limit upland game bird numbers, either, through adult mortality or through impairment of fertility.

(b) Sodium chloride and calcium chloride

Claims that partridge and pheasant were dying as a result of eating sodium chloride and calcium chloride could not be verified. There was no reason to believe that "salt poisoning" was a major factor limiting the numbers of upland game birds.

5. Natural Vegetation

The results of the field investigation indicated that food, nesting, escape and roosting cover were adequate for reasonably high partridge populations, but inadequate for more than nominal pheasant populations.

6. Soil

It seemed likely that Prince Edward Island soil conditions did not affect the distribution or survival of Gray Partridge, but that adverse soil conditions may have been a limiting factor to Ring-necked Pheasant.

7. Reduction in Area under Cultivation

It was probable that the reduction in the number of acres under cultivation, with a subsequent loss of suitable

range for partridge and pheasant, helped to reduce the populations of those birds. However, at the present time, the reduction in range does not appear to be an important factor in limiting population increase. Though the abandonment of farms may provide very favourable habitat, the decrease in the number of occupied farms has been continuous and the change in habitat hardly seems to have been abrupt enough to cause a serious decline in upland game.

8. Farm Mechanization

Farm mechanization has increased on Prince Edward Island in the past several years. It was probable that increased efficiency in hay cutting has resulted in increased mortality of game birds nesting in hay fields. Grain combines leave less waste grain and weed seeds in fields, and therefore reduce the amount of food available for wintering game birds. However, increased mechanization on farms was not considered to have been a major limiting factor to partridge and pheasant on Prince Edward Island.

9. Climate

Unfavourable winter conditions appear to have been the most important extrinsic factors in limiting upland game bird populations on Prince Edward Island. Deep snows, freezing rain and low temperatures during the winter of 1956-57 probably contributed, directly and indirectly, to the

death of a majority of the pheasant and partridge of the Island. It seems possible that the populations of these birds did not recover sufficiently before they were again subjected to very adverse weather during the winter of 1960-61. Most of the remaining individuals in the surviving population of Ring-necked Pheasant and Gray Partridge apparently died as a direct consequence.

Recommendations

1. Do not stock Gray Partridge on Prince Edward Island. If the weather is not too severe in the next three to four winters the species will probably be able to rebuild its numbers by natural reproduction.
2. Do not stock Ring-necked Pheasant with a view to establishing a self-maintaining population. It is likely that this species will not survive permanently on the Island.

3. If pheasant shooting is desired, be prepared to obtain it on an annual put-and-take basis.

4. Discontinue the payment of bounties on predatory animals. The money presently paid in bounties should be used to pay professional hunters to control predators, if the need for such control should ever arise.

5. It is recommended that the assessment of partridge and pheasant populations on Prince Edward Island should be continued. Frequent counts should be made on census plots. Specimens, of birds and their eggs, should be taken throughout the year, and examined for foods eaten, nutritive condition, parasites, disease, and biocide residues. The birds should be subjected to particularly careful study during periods of climatic stress. It is only in this way that a thorough analysis of the factors limiting partridge and pheasant numbers on Prince Edward Island can be obtained.

Table 20 - Relative importance of various factors on the population size of Gray Partridge and Ring-necked Pheasant on Prince Edward Island.

Factor	Probable Effect on Upland Game Bird Population Size
Predation	None
Disease	None
Hunting	Slight
Chemicals	Slight
Natural Vegetation	None
Soil	Slight
Acreage changes of crops	Slight
Mechanization of farms	Slight
Climate	Extreme

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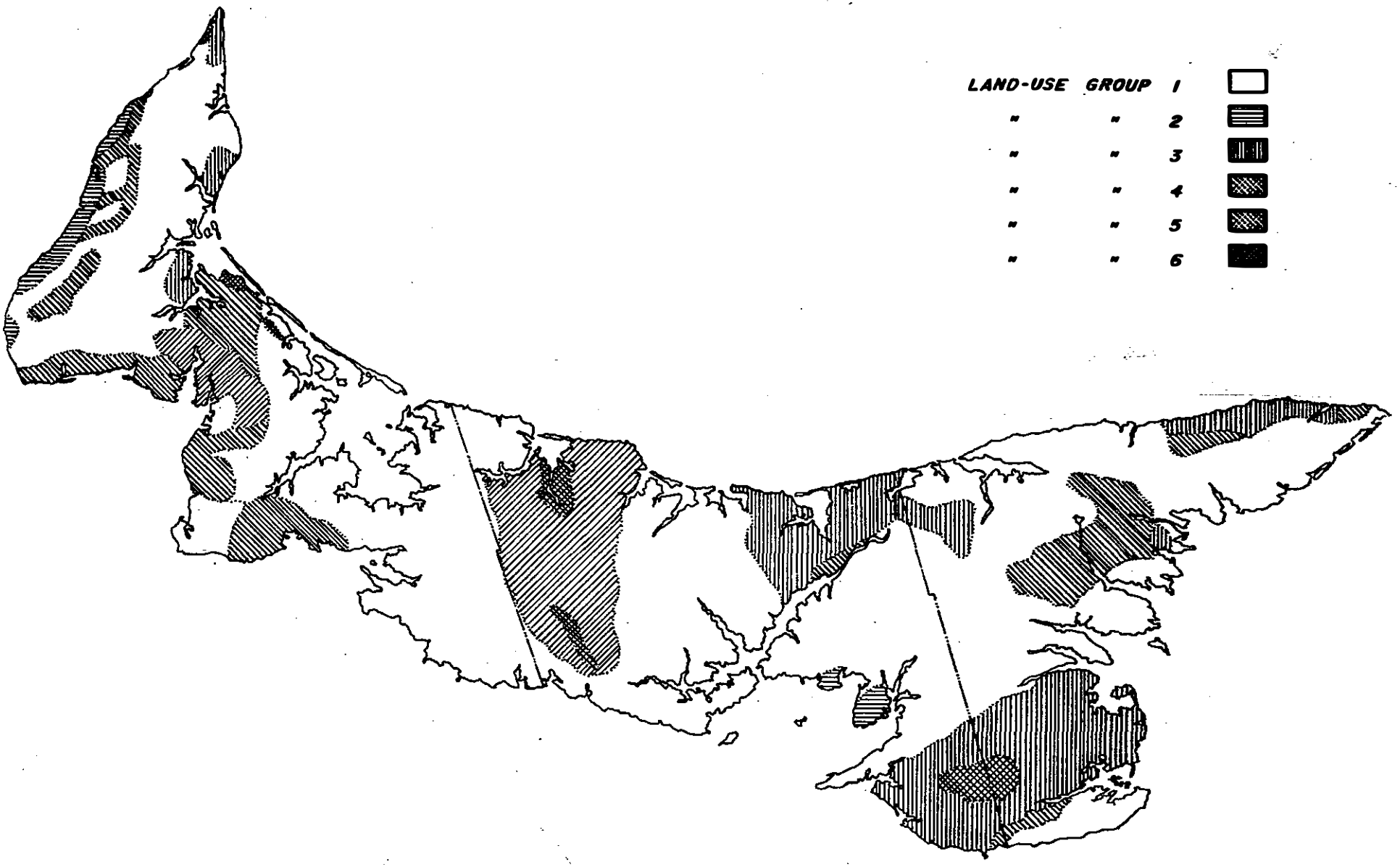

FIG. 1 – LAND-USE GROUPS, PRINCE EDWARD ISLAND, (after WHITESIDE, 1950)

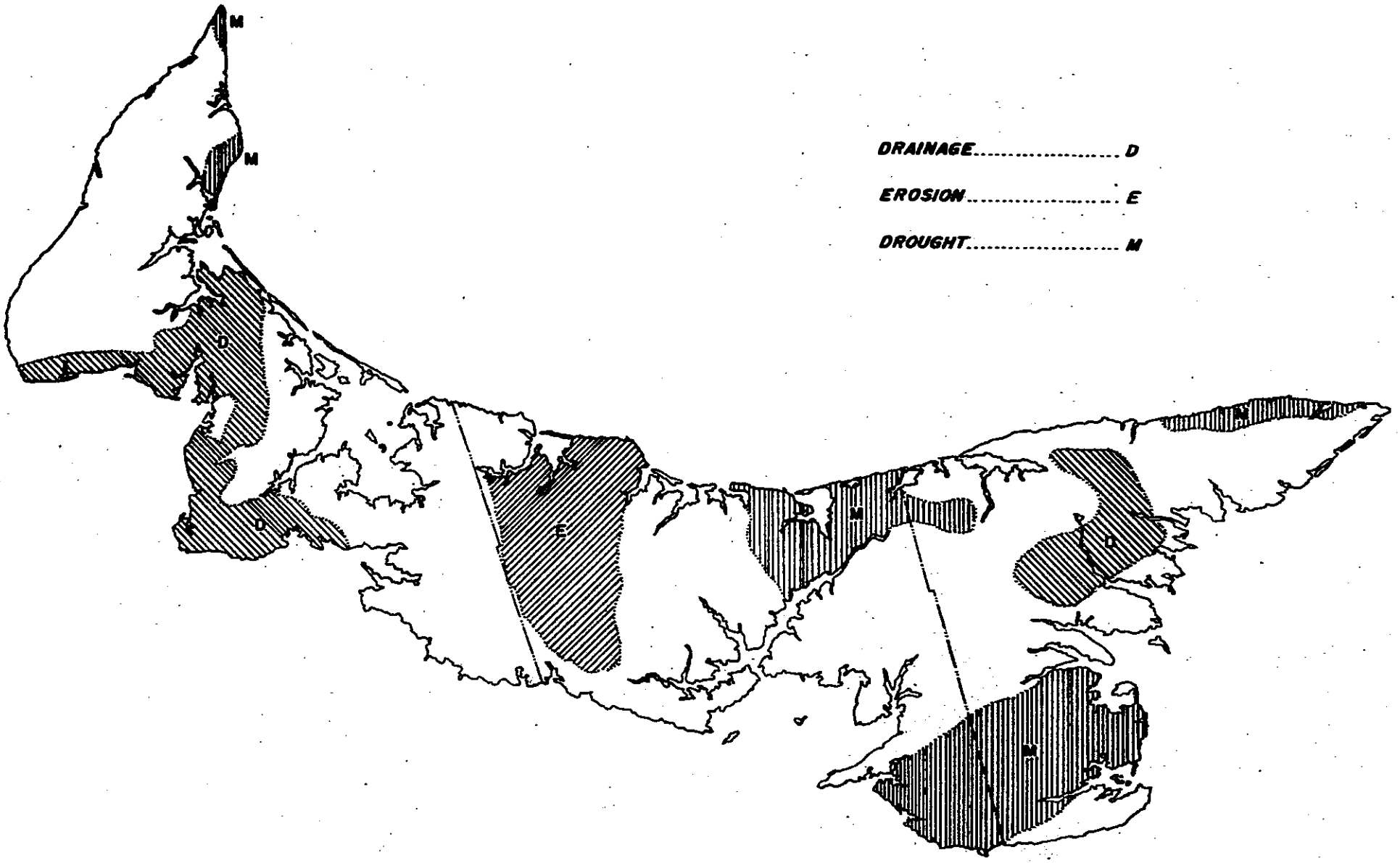

FIG. 2 – SOIL PROBLEM AREAS, OTHER THAN FERTILITY, PRINCE EDWARD ISLAND. (after WHITESIDE, 1950)

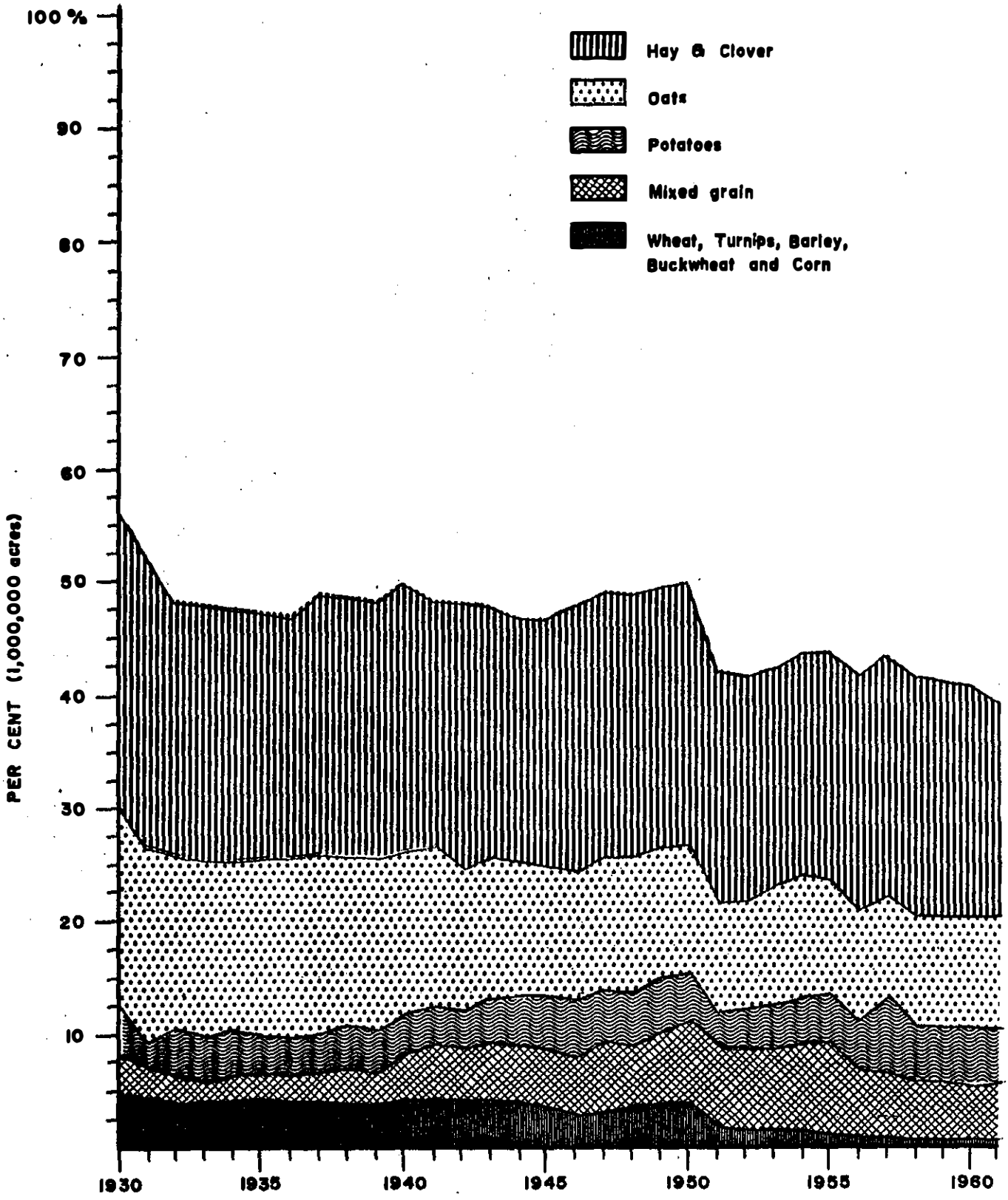

FIG. 3 : Relative composition of cultivated crops on Prince Edward Island, 1930 - 1961

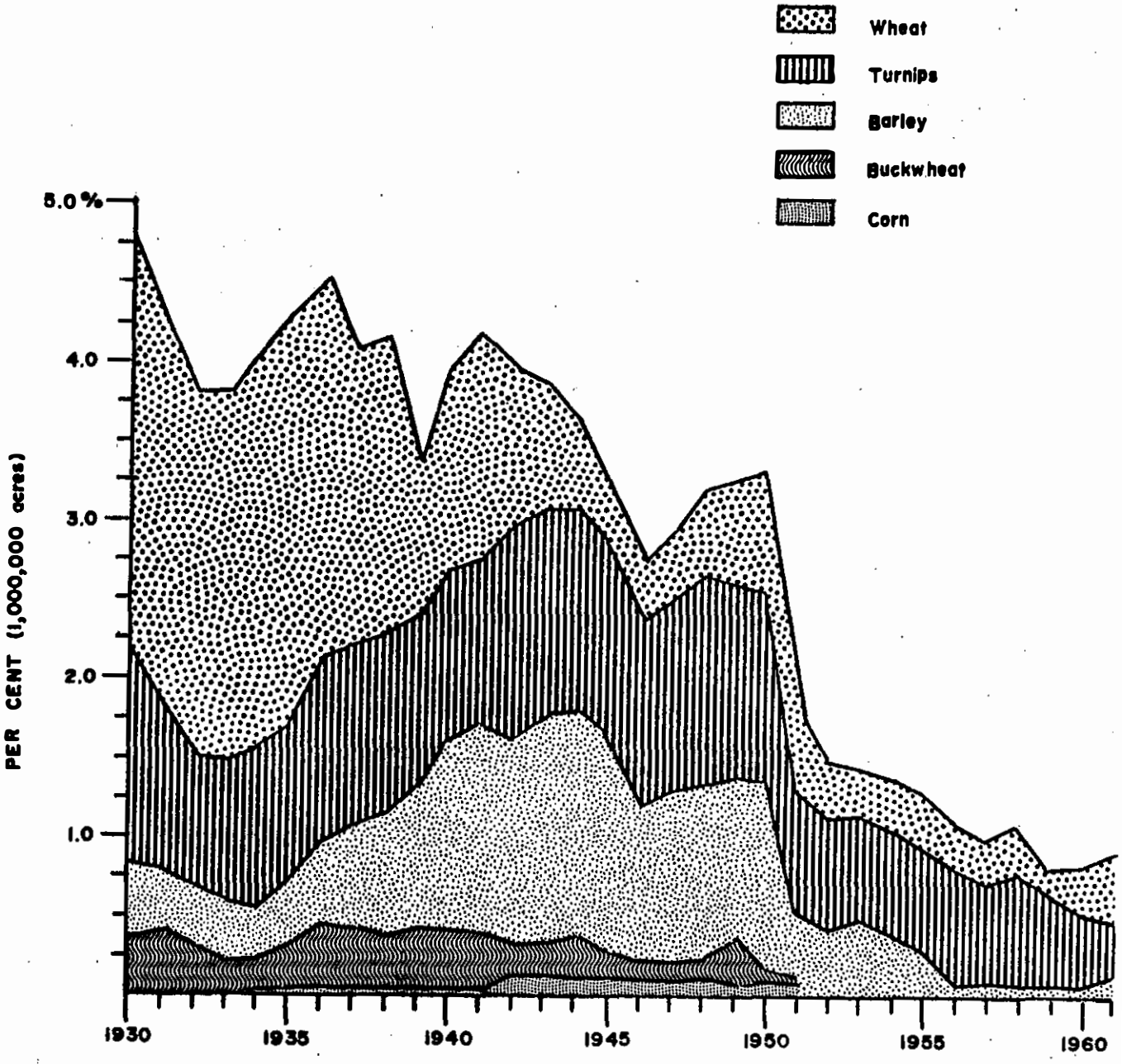

FIG. 4 : Relative composition of crops other than, hay and clover, oats, potatoes and mixed grain on Prince Edward Island. 1930-1961

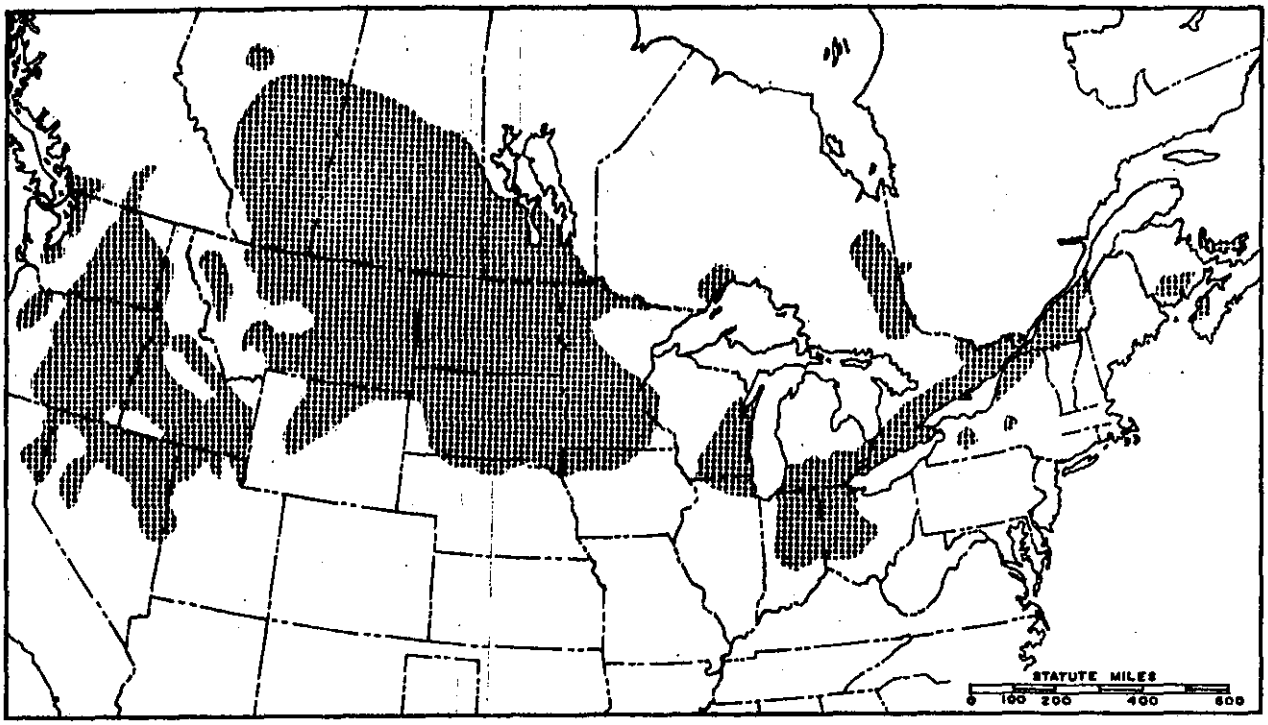

FIG 5. DISTRIBUTION OF GRAY PARTRIDGE IN NORTH AMERICA, (after ALDRICH & DUVALL, 1955)

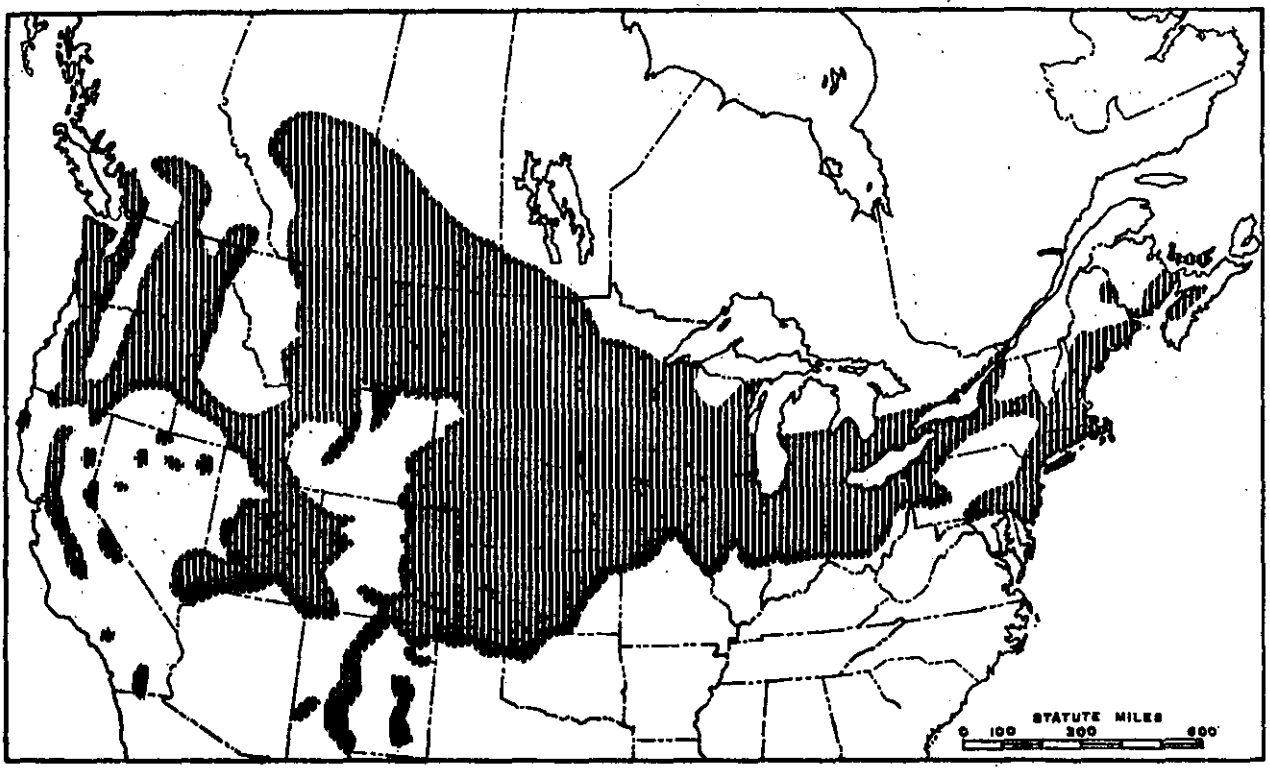

FIG.6_ DISTRIBUTION OF RING-NECKED PHEASANT IN NORTH AMERICA, (after ALDRICH & DUVALL, 1955)

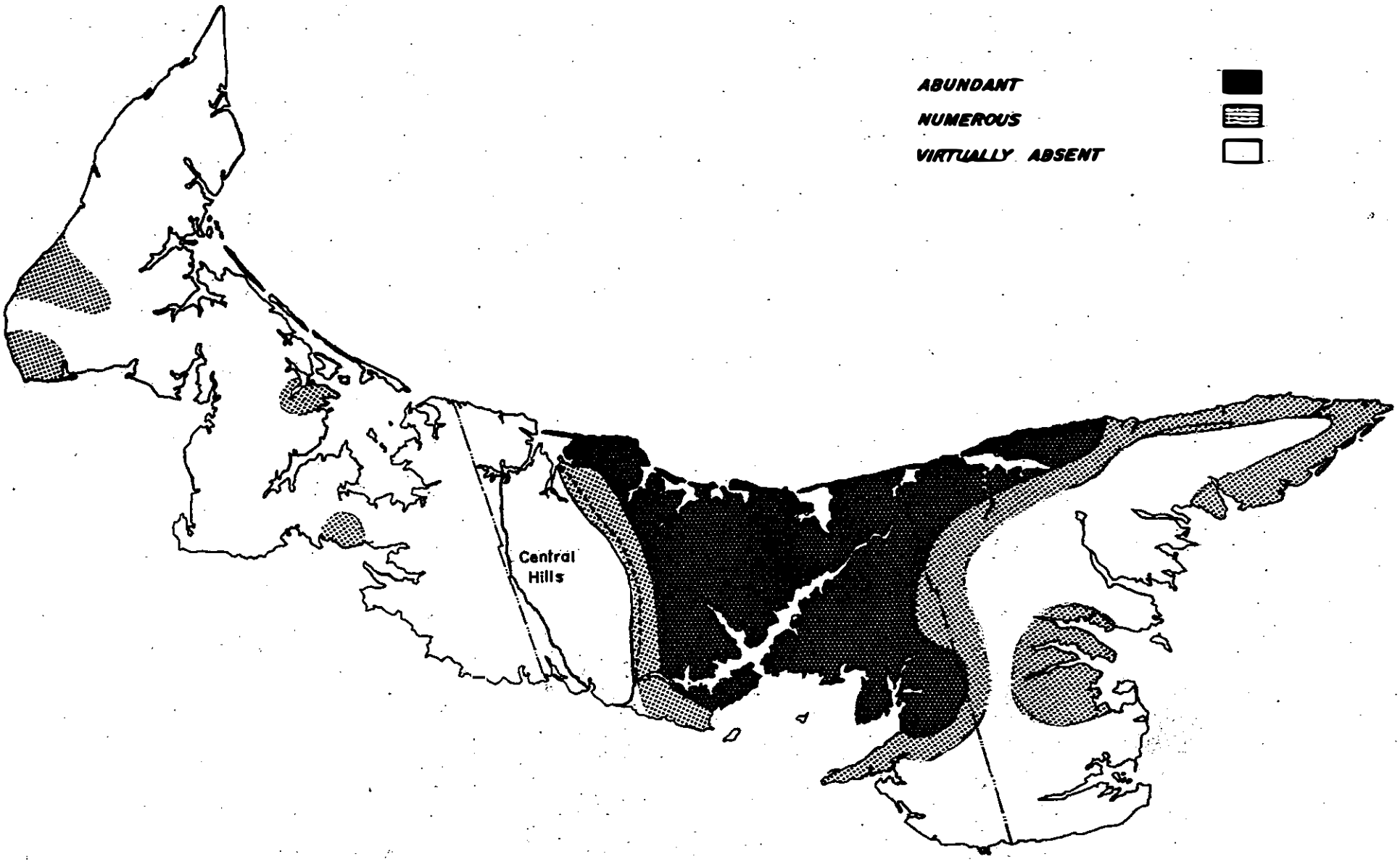

FIG. 7_FORMER DISTRIBUTION OF RING-NECKED PHEASANT, PRINCE EDWARD ISLAND.

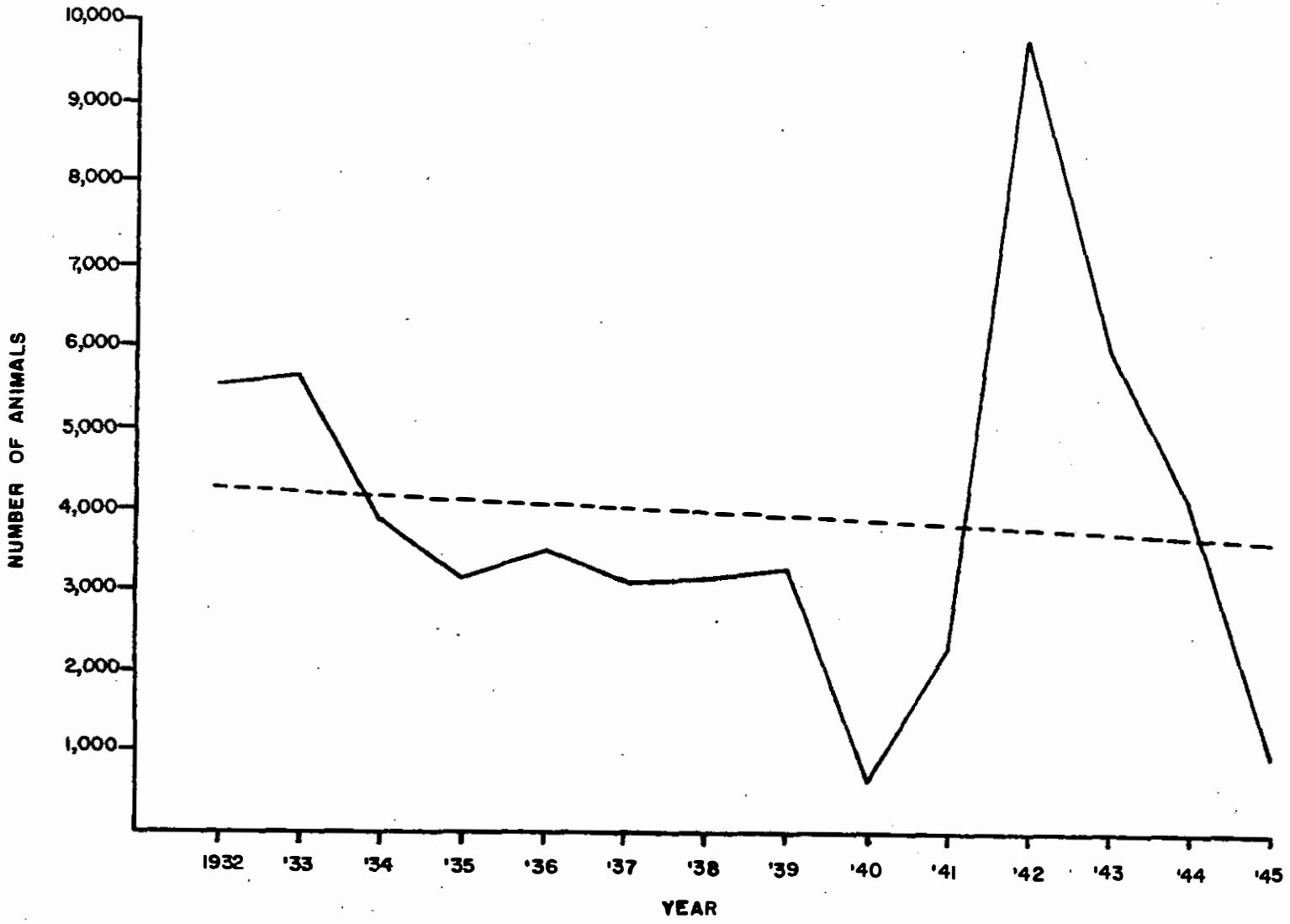

FIG. 8 Number of skunks presented for bounty, 1932—1945. Trend indicated by broken line.

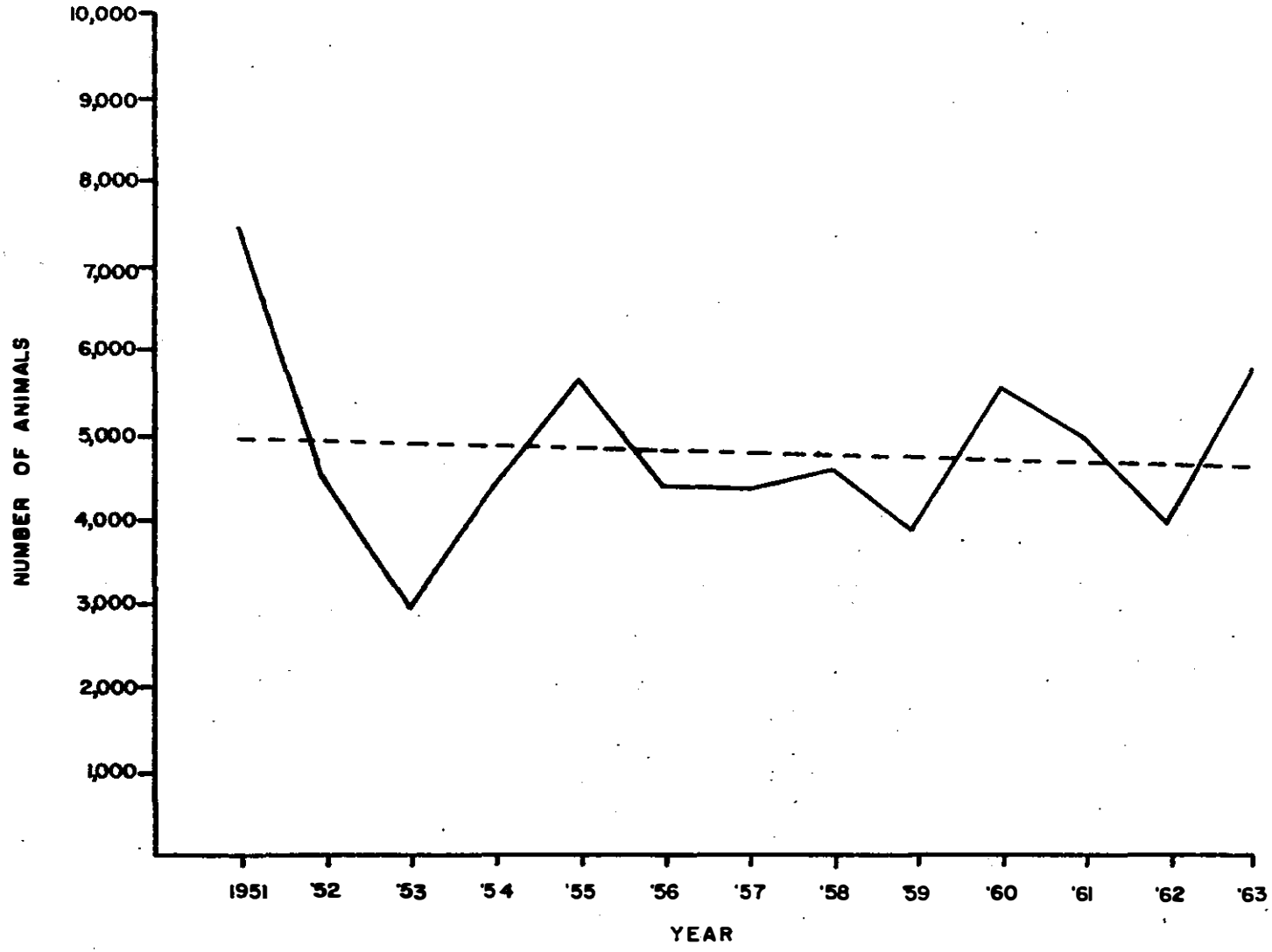

FIG. 9 Number of skunks presented for bounty, 1951—1963. Trend indicated by broken line.

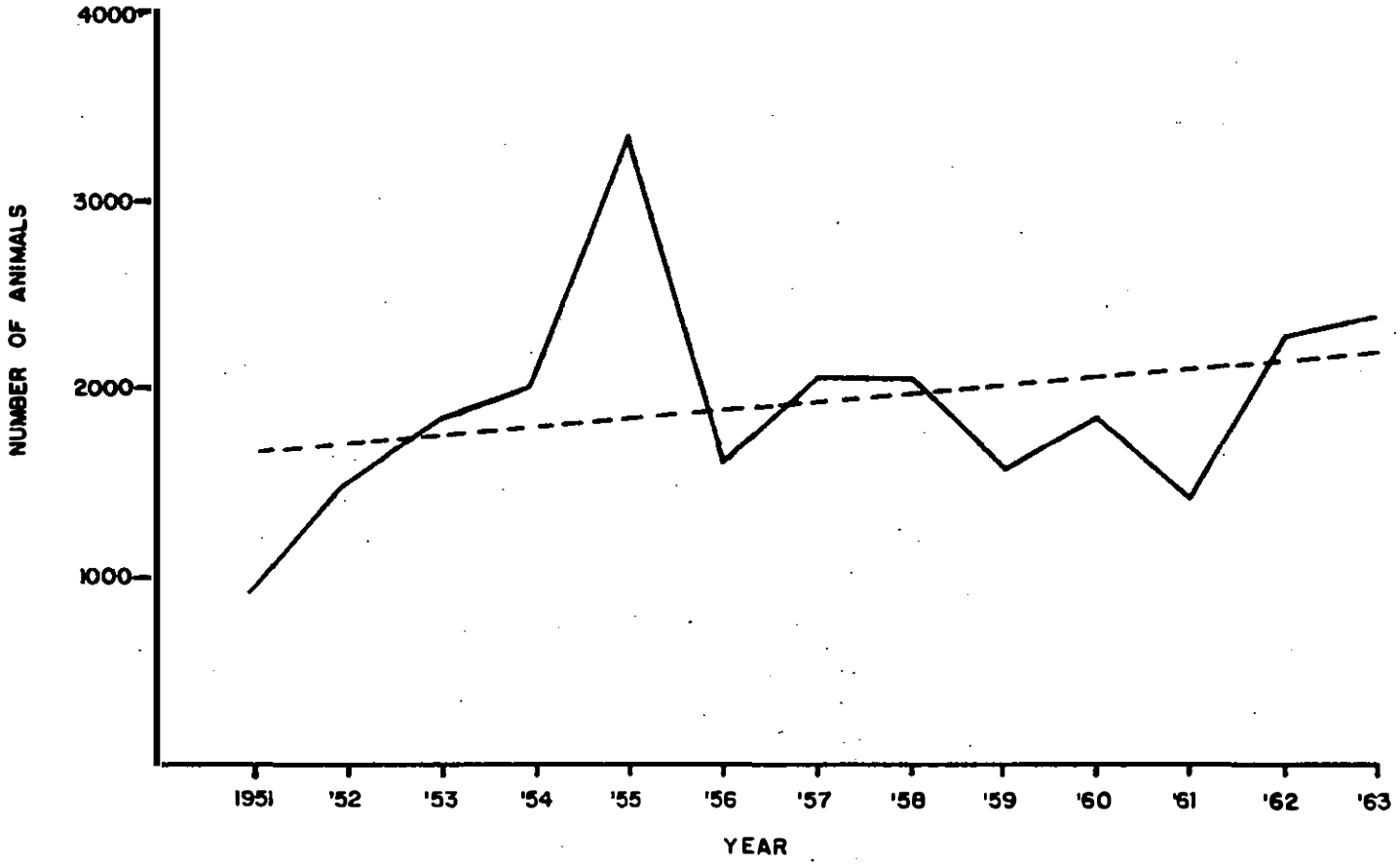

FIG. 10 Number of foxes presented for bounty, 1951—1963. Trend indicated by broken line.

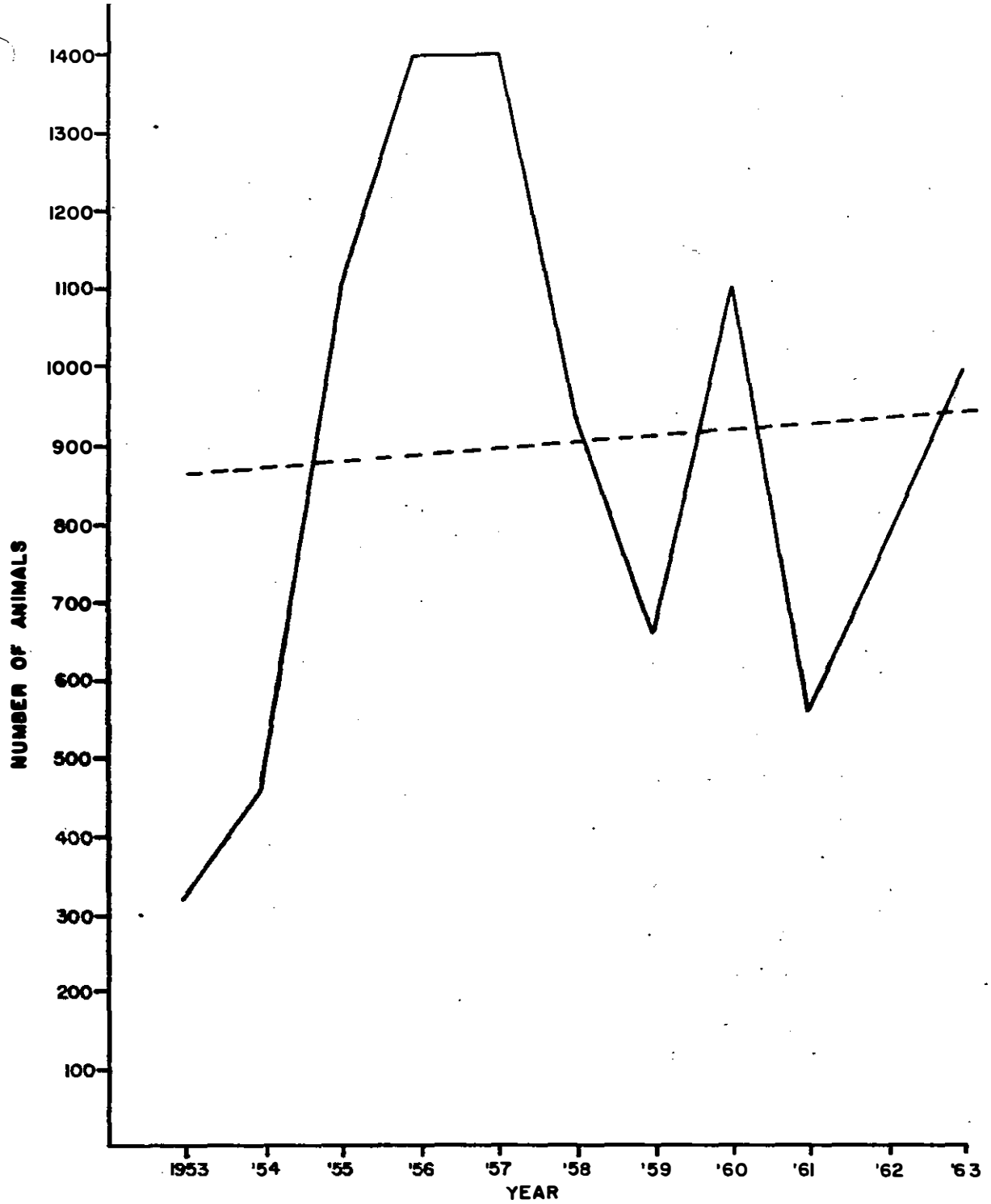

FIG. 11 Number of raccoons presented for bounty, 1953.–1963. Trend indicated by broken line.

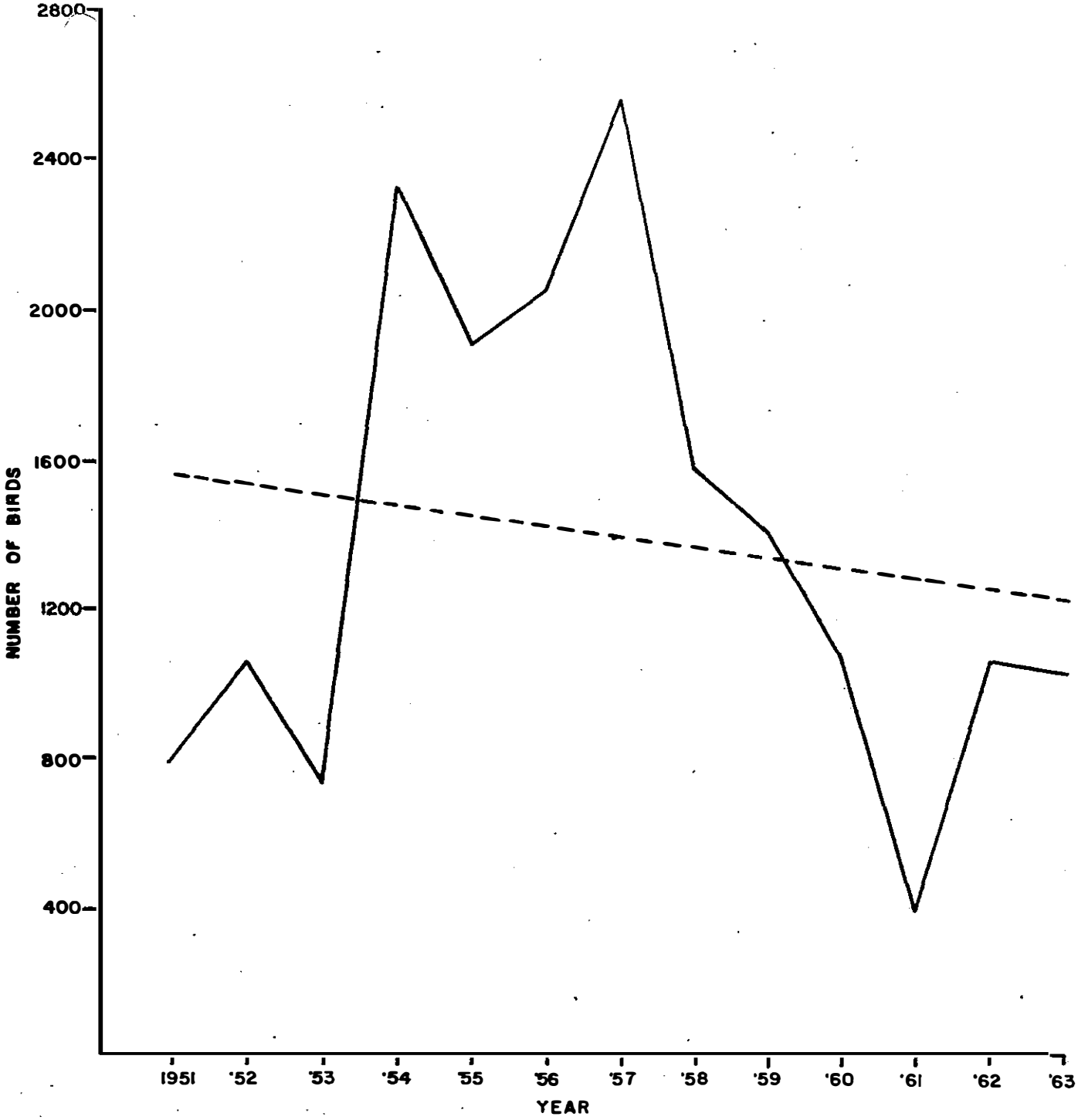

FIG. 12 Number of crows presented for bounty, 1951–1963. Trend indicated by broken line.

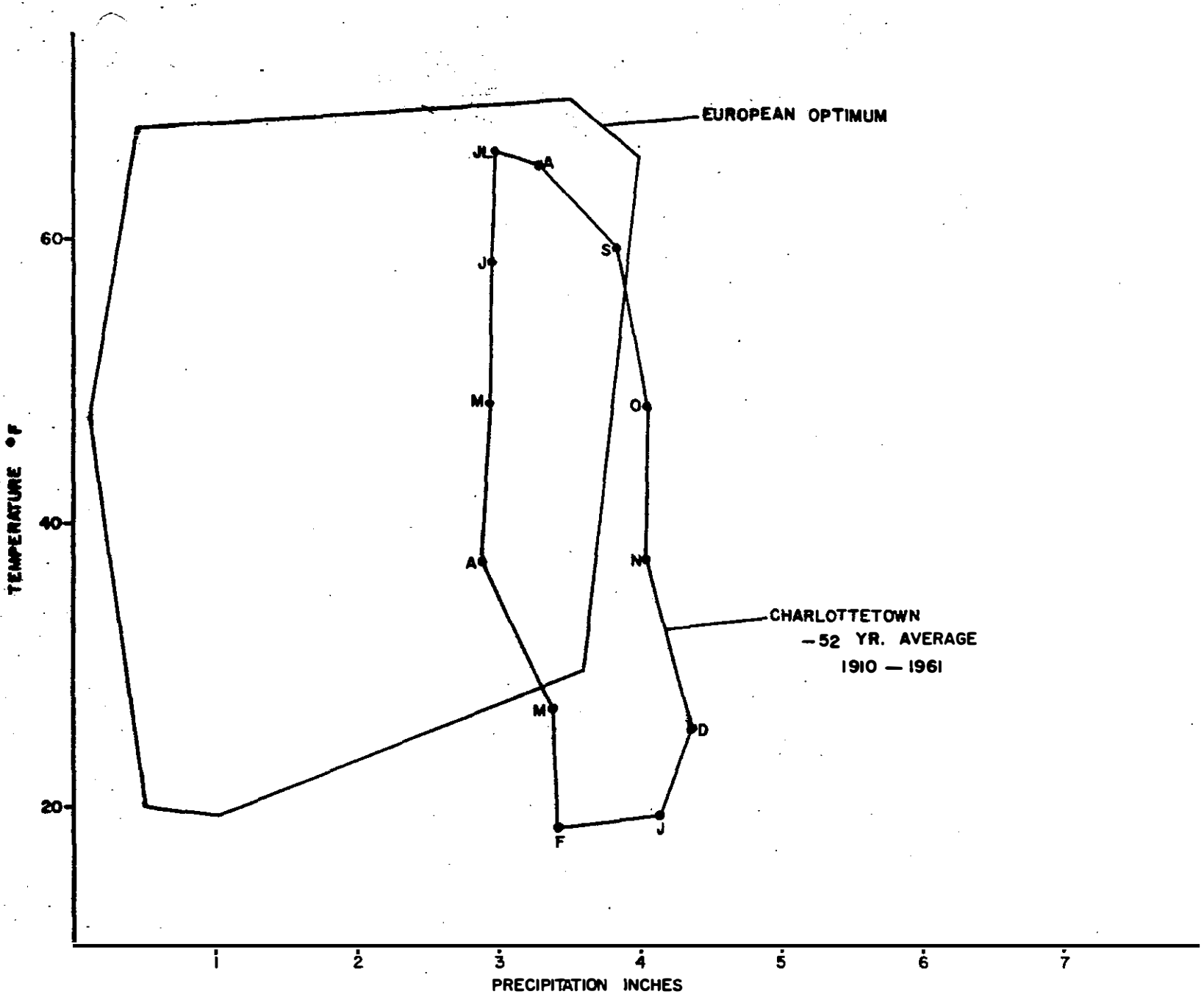

FIG. 13 CLIMOGRAPH INDICATING EUROPEAN OPTIMUM TEMPERATURE AND PRECIPITATION FOR GRAY PARTRIDGE COMPARED WITH THE CONDITIONS AT CHARLOTTETOWN. (partly after Twomey, 1936)

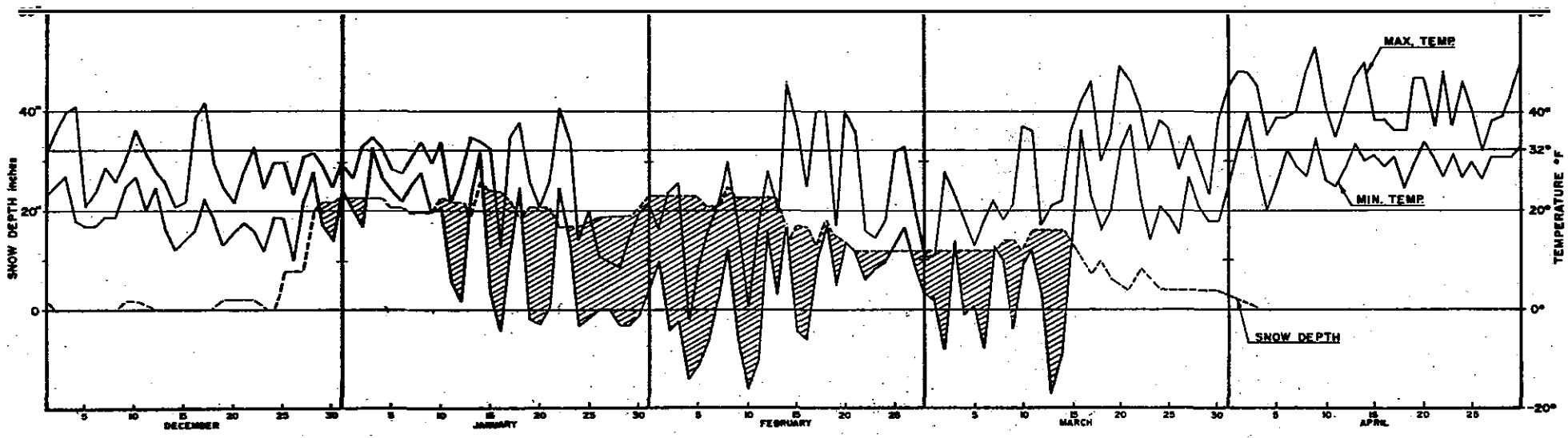

FIG. 14 DAILY MAXIMUM AND MINIMUM TEMPERATURES AND ACCUMULATED SNOW FOR CHARLOTTETOWN, DECEMBER TO APRIL, 1947-48.
Cross hatched areas indicate conditions considered to be detrimental to gray partridge and ring-necked pheasants.

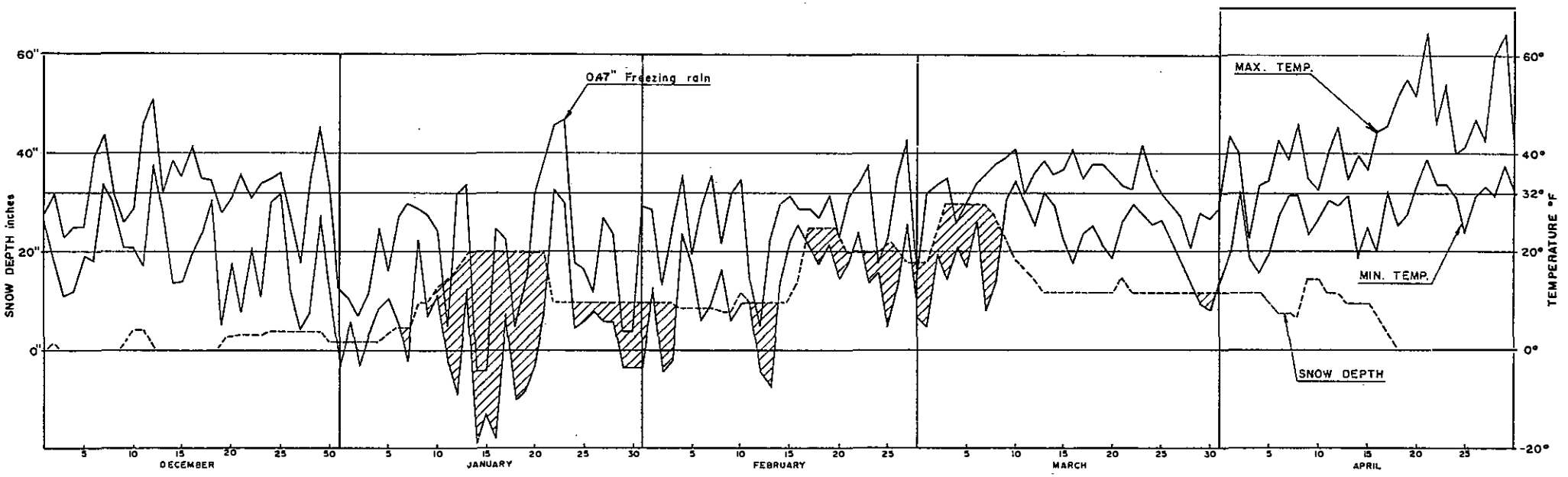

FIG. 15 DAILY MAXIMUM AND MINIMUM TEMPERATURES AND ACCUMULATED SNOW FOR CHARLOTTETOWN, DECEMBER TO APRIL, 1956-57.
Cross hatched areas indicate conditions considered to be detrimental to gray partridge and ring-necked pheasants.

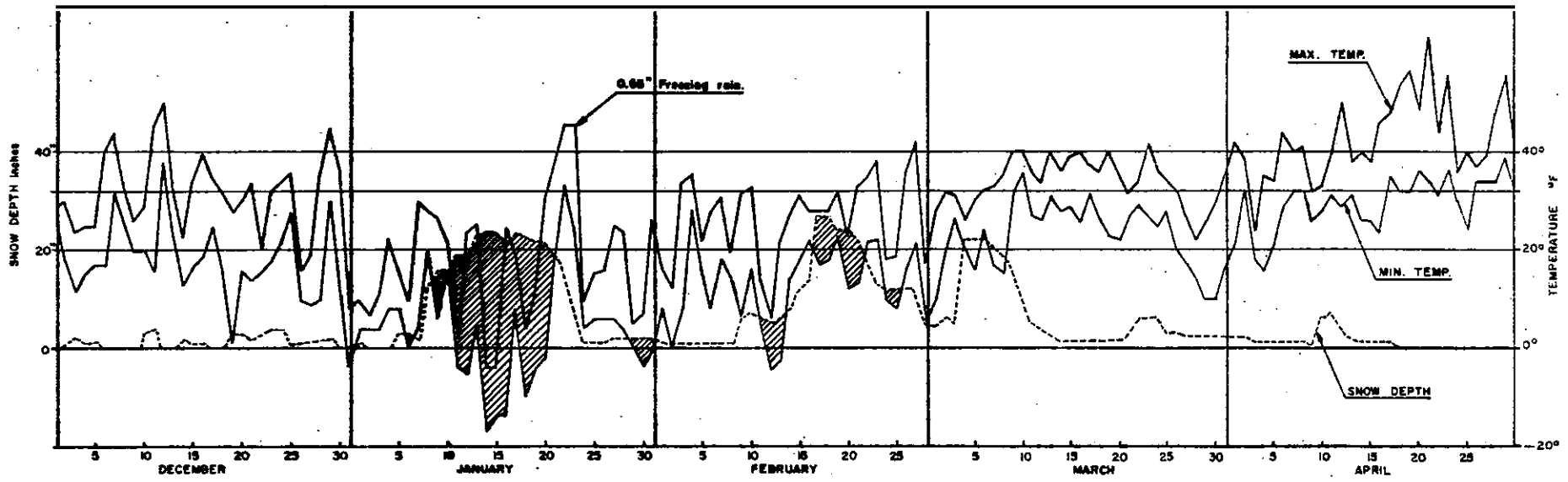

FIG. 16 DAILY MAXIMUM AND MINIMUM TEMPERATURES AND ACCUMULATED SNOW FOR SUMMERSIDE, DECEMBER TO APRIL, 1956-57.
Cross hatched areas indicate conditions considered to be detrimental to gray partridge and ring-necked pheasants.

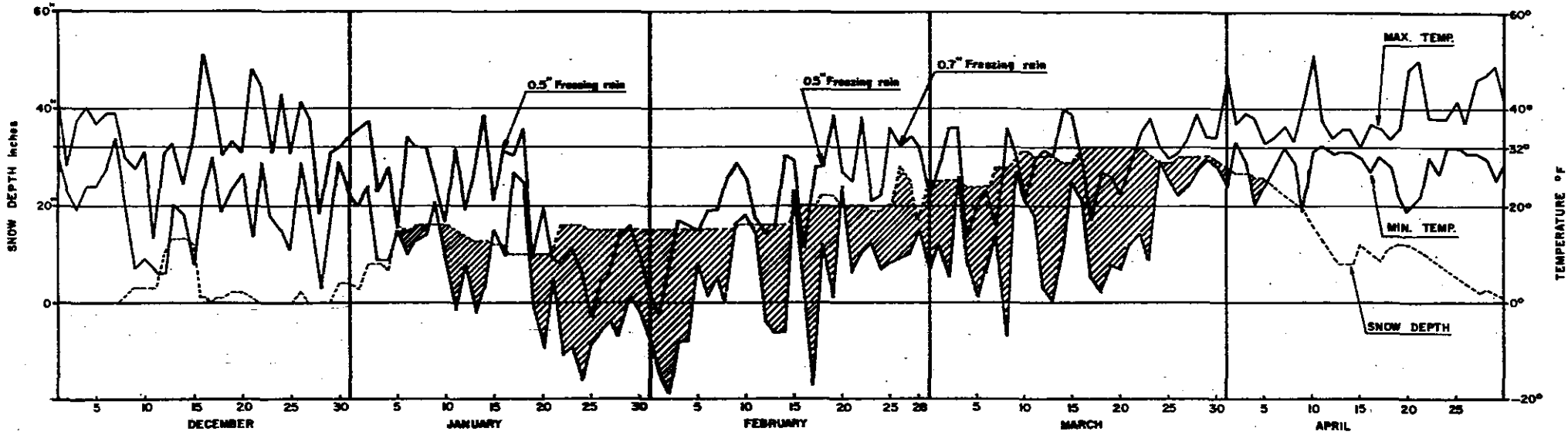

FIG. 17 DAILY MAXIMUM AND MINIMUM TEMPERATURES AND ACCUMULATED SNOW FOR CHARLOTTETOWN, DECEMBER TO APRIL, 1960-61.
Cross hatched areas indicate conditions considered to be detrimental to gray partridge and ring-necked pheasants.

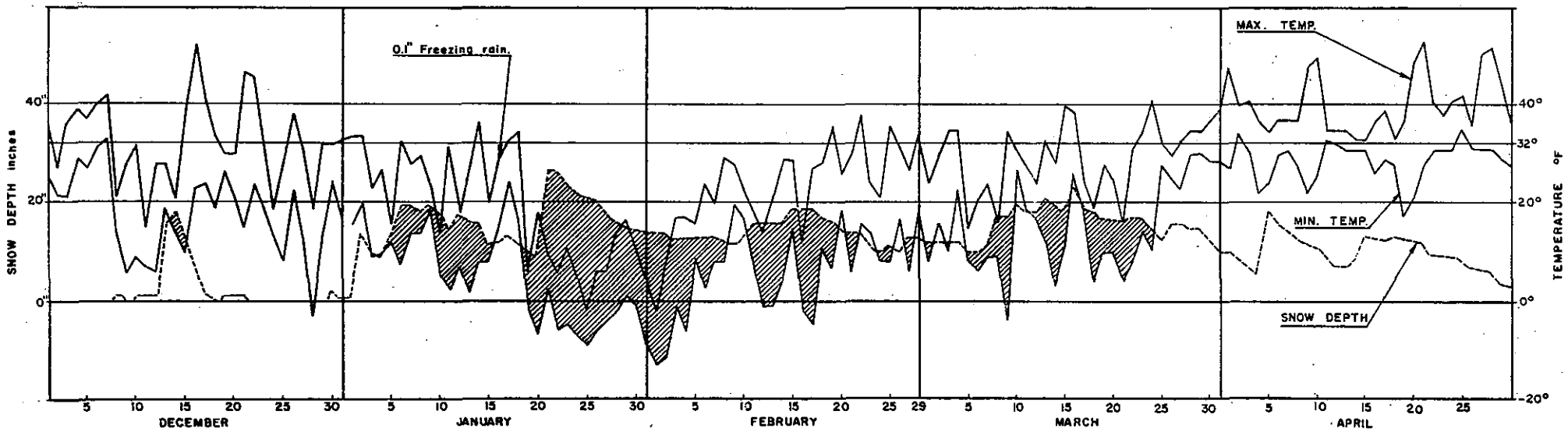

FIG. 18 DAILY MAXIMUM AND MINIMUM TEMPERATURES AND ACCUMULATED SNOW FOR SUMMERSIDE, DECEMBER TO APRIL, 1960-61.
Cross hatched areas indicate conditions considered to be detrimental to gray partridge and ring-necked pheasants.

CANADA

GEOGRAPHICAL BRANCH
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

DIRECTION DE LA GÉOGRAPHIE
MINISTÈRE DES MINES ET DES RELEVÉS TECHNIQUES

QUEENS COUNTY

PRINCE EDWARD ISLAND

Scale 1:126,720 Échelle

Miles 2 1 0 2 4 6 8 10 Milles

Kilometres 2 1 0 2 4 6 8 10 12 14 Kilomètres

Elevations in feet above Sea Level

Transverse Mercator Projection

Altitude en pieds au-dessus du niveau de la mer

Projection transverse de Mercator

LEGEND — LÉGENDE

- Industrial Areas / Zones industrielles
- Commercial Areas / Zones commerciales
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- Recreational Areas / Parcs et terrains de jeux
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- Scrub Woodland / Terrains broussailleux
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- Unproductive Land / Terrains improductifs
- Swamps and Marshes / Marécages et tourbières
- Areas leased for oyster beds / Terrains affermés pour parcs à huîtres
- Indian Reserves / Réserves indiennes
- Parks / Parcs

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Recent forest fire information supplied by Prince Edward Island Department of Agriculture. Other forest information obtained by interpretation of R.C.A.F. air photographs.

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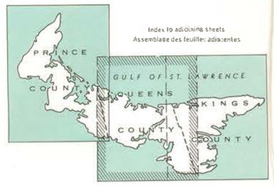

Index to adjoining sheets
Assemblage des feuilles adjacentes

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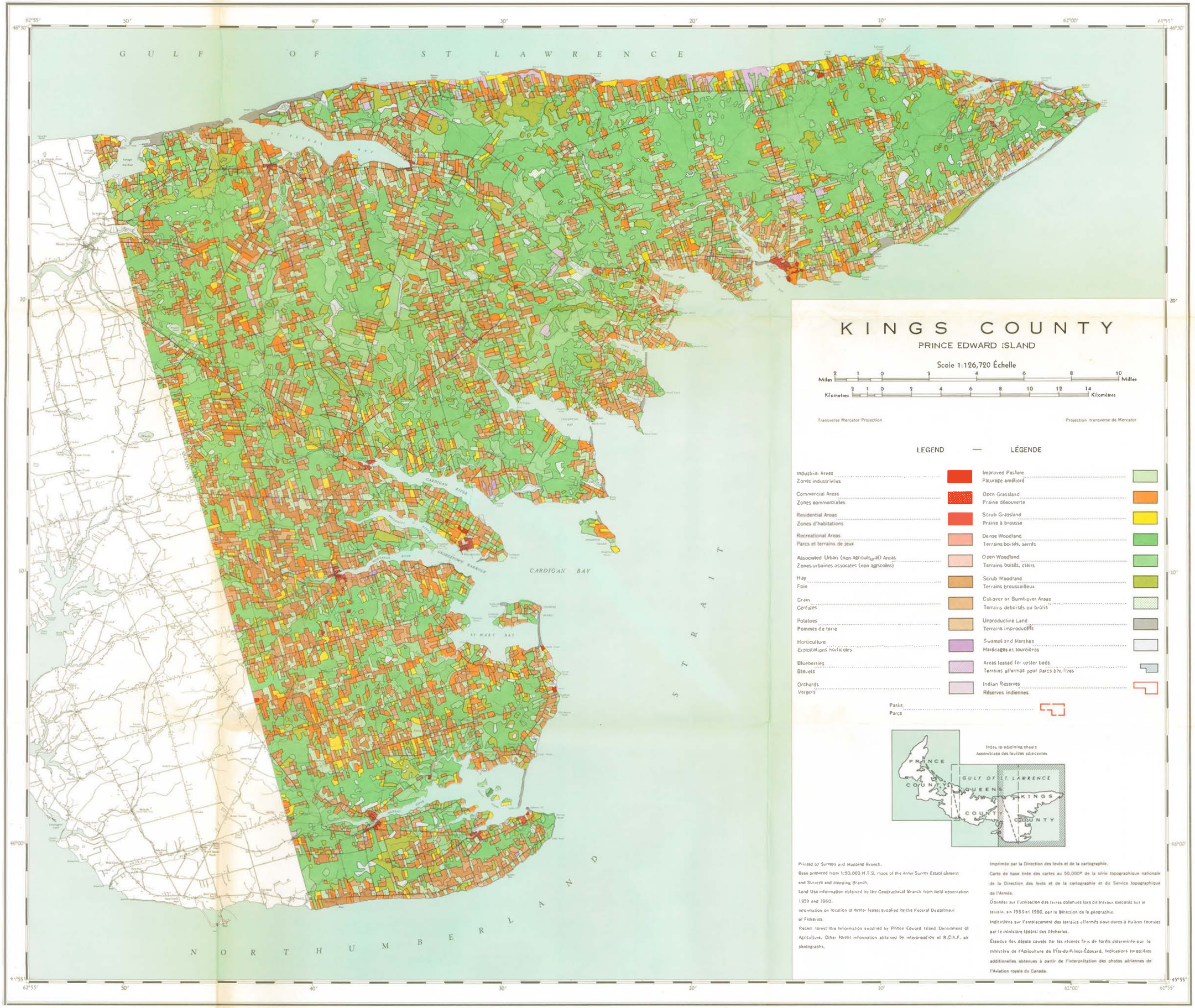
LAND USE SERIES

SÉRIE DE L'UTILISATION DES TERRES



KINGS COUNTY

PRINCE EDWARD ISLAND

Scale 1:126,720 Échelle

Miles 2 1 0 2 4 6 8 10 Milles

Kilometres 2 1 0 2 4 6 8 10 12 14 Kilomètres

Transverse Mercator Projection

Projection transverse de Mercator

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DEPARTMENT OF MINES AND TECHNICAL SURVEYS

DIRECTION DE LA GÉOGRAPHIE
MINISTÈRE DES MINES ET DES RELEVÉS TECHNIQUES

LAND USE SERIES

SÉRIE DE L'UTILISATION DES TERRES

PRINCE COUNTY

PRINCE EDWARD ISLAND

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Kilometres 2 1 0 2 4 6 8 10 12 14 Kilomètres

Transverse Mercator Projection

Projection transverse de Mercator

Index to adjoining sheets
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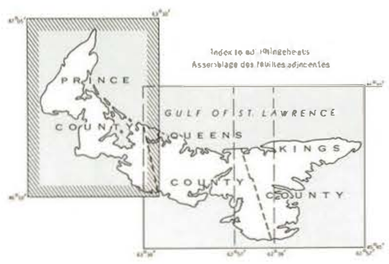

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- Scrub Woodland / Terrains broussailleux
- Cut-over or Burnt-over Areas / Terrains déboisés ou brûlis
- Unproductive Land / Terrains improductifs
- Swamps and Marshes / Marécages et tourbières
- Areas leased for oyster beds / Terrains affermés pour parcs à huîtres
- Indian Reserves / Réserves indiennes

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Données sur l'utilisation des terres obtenues lors de travaux exécutés sur le terrain, en 1959 et 1960, par la Direction de la géographie.
Indications sur l'emplacement des terrains affermés pour parcs à huîtres fournies par le ministère fédéral des Pêcheries.
Étendue des dégâts causés par les récents feux de forêts déterminée par le ministère de l'Agriculture de l'Île-du-Prince-Édouard. Indications forestières additionelles obtenues à partir de l'interprétation des photos aériennes de l'Aviation royale du Canada.

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