The Canadian Breeding Bird (Mapping) Census Database

J.A. Kennedy, Pam Dilworth-Christie and A.J. Erskine

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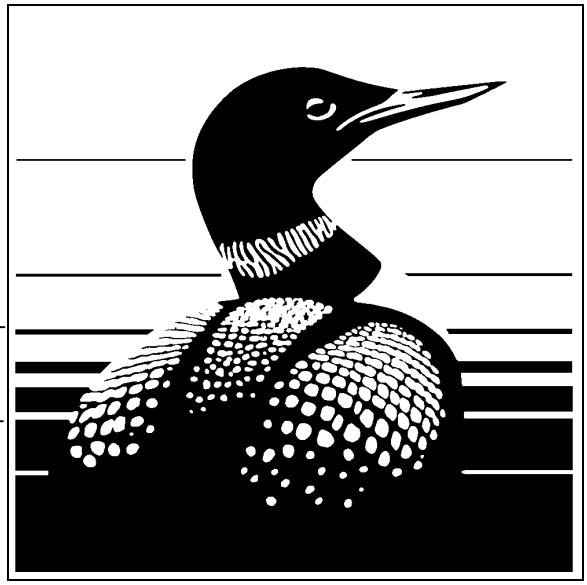

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The Canadian Breeding Bird (Mapping) Census Database

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Abstract

This report describes the contents of the Canadian Breeding Bird (Mapping) Census Database. The data are derived from “spot- or territory-mapping” censuses in variably-sized plots across Canada. Habitat codes are appended to each plot to define the primary, and, often, secondary, habitat types present within the plot, and dominant canopy, shrub and ground cover species are listed. Densities are calculated per 100 hectares for all bird species detected on a plot. The databases contain 928 censuses of 640 distinct plots, with records for 285 species of birds. Censuses span the years from 1927 to 1993, and were conducted in every province and territory except Prince Edward Island. The bulk of the data were collected between the mid-1960s and the early 1980s, after which point there was a steady decline in censusing. The databases and report are available for downloading from this site.

Acknowledgements

Our thanks to the Cornell Laboratory of Ornithology for initial work computerising census data published in *American Birds*; Ron Fritz and Rob Alvo for data entry and extensive and careful quality control work; and Kathy Dickson, Dawn Phillips and Iain Christie for valuable technical assistance. Helpful comments on the manuscript were provided by Connie Downes, Erica H. Dunn and J. Stephen Wendt.

Introduction

History of the Breeding Bird Census in North America

The Breeding Bird Census (BBC) is one of the longest-running surveys of bird populations in North America, and is designed to help determine abundance and distribution patterns of bird species. The first Canadian census plots were surveyed in the arctic in 1929, but preceded the formation of a wider program in Canada. Williams (1936) stimulated broader use of the technique, and between 1937 and 1984, the National Audubon Society promoted BBCs across North America and published the results annually in *American Birds* and its predecessor publications. The Cornell Laboratory of Ornithology assumed the administration of the BBC in 1985. Although the results were not published for several years during the 1980s, they subsequently appeared in a supplement to the *Journal of Field Ornithology* during the 1990's. More information on the Breeding Bird Census program in the U.S. is provided by the USGS National Biological Survey.

About the Breeding Bird Census

The BBC is conducted by experienced volunteers and researchers on a measured plot of land. A formalised methodology was published (Hall 1964, Van Velzen 1972) to promote consistent use of the technique. The "spot-mapping" or "territory mapping" method used provides estimates of population densities for each species present in the census plot. Observers map the location of all singing males and pairs present in the plot on different days during the breeding season. When these locations are combined for the entire season, individual territories can be identified. Assuming that each territory is occupied by a pair of that species, the number of territories is equivalent to the number of breeding pairs in the plot (Williams 1936; Stewart and Aldrich 1949; Robbins 1970; Johnston 1990). Accompanied by detailed habitat descriptions (James 1970), the BBC can assess the use of different habitat types by a species.

The aims of a census using the mapping method are:

- to establish annual indices of population levels;
- to estimate population densities; and
- to investigate the species composition of a community, and the relative abundance of different species (Robbins 1970).

Breeding bird censuses provide the only habitat-specific density data based on repeat records of individuals in the same area throughout the breeding season. The repeat visits yield a relatively accurate estimate of bird populations, probably more accurate than the more quickly conducted point count. As a result, breeding bird censuses might be more sensitive than other surveys to population changes, particularly at a local level. It is possible to monitor annual fluctuations in vegetation and food abundance in a plot, and to examine interspecific dynamics of birds. This information can, in turn, contribute to the development of conservation strategies (Johnston and Hagan 1992). Because the data are habitat-specific, it may be possible to measure the effects of various land-use practices on breeding bird populations, or quantify the yearly variation in densities of breeding birds occupying various habitat types (Lowe 1989). The data may also be useful in determining species richness indices for particular habitats, as well as identifying the habitat requirements of individual species, all of which could improve our ability to provide adequate habitat for birds in Canada (Butcher 1986).

Limitations of the BBC data

Like point counts, breeding bird censuses have limits to the statistical robustness of the data. The main drawbacks are: few plots of small area were sampled so that habitats are not represented in proportion to their occurrence on the landscape; and few plots were replicated, thus limiting the number of samples for statistical analysis. The mapping method is applied primarily to territorial and non-colonial passerines, but applies to any species for which breeding activity is *relatively* stationary (including species such as woodpeckers that only defend the nest-site, but which are only active within a focused area). Birds such as ducks, geese, sea-birds and some waders cannot be adequately censused using this method. Johnston (1990) described other factors which could limit the utility of census data.

Origins of the Canadian Breeding Bird Census Database

The Canadian Wildlife Service has played an active role in managing Breeding Bird Census data in Canada. In 1969, the International Bird Census Committee (a committee of scientists appointed at the International Study Conference on Bird Census Methods and Results held at Hillerød, Denmark) recommended that each country assemble a summary of bird censuses using the "mapping method". The Canadian response to this was the *Preliminary Catalogue of Bird Census Plot Studies in Canada*. The catalogue was published in five sections as Canadian Wildlife Service Progress Notes (Publications order form) from 1971 to 1984 (Erskine 1971, 1972, 1976, 1980, 1984). This catalogue provided density information for only the 5 most common species in a plot to guide researchers to sources of data on species and habitats of particular interest to them.

The first sections of the *Preliminary Catalogue* stimulated the United States Fish and Wildlife Service to start computerising the North American census data published in *Audubon Field Notes* and *American Birds*. The Cornell Laboratory of Ornithology (CLO) assumed both the database and the task of completing computerisation in 1985. The Canadian Wildlife Service acquired a copy of the Canadian component of the database in 1989, which formed the basis for the current database.

The CLO dataset represented only about 1/3 of the census plots conducted in Canada. The remainder of Canadian census data was published in other sources, or in unpublished reports, theses and census lists. Copies of the source documents are archived at the National Office of Canadian Wildlife Service, and are cited for each record in the database, except data that were personal communications to A.J. Erskine (Fritz 1996). During compilation of the Canadian data, extensive quality checking ensured accuracy and provided standardised units for all fields.

The Canadian Breeding Bird Census Database (CBBCD) contains records for all known spot-mapping censuses (928 censuses of 640 distinct plots) carried out in Canada during the period 1929-1993. More recent data may be included as they are submitted. The database includes plots of less than 10 ha in size (the minimum recommended by Robbins 1970) as, prior to 1970, a minimum plot size of 6 ha was recommended by the National Audubon Society. These smaller plots may be of interest in some investigations, but their bird populations are likely influenced by "edge effect" (as are those in large plots of narrow configuration).

Canadian Breeding Bird Census Database

The CBBCD is comprised of two data tables, Plots and Species. The Plots table (described in Table 1) contains descriptive information for each of 640 individual mapping census plots (928 records), source citations and summary data including the number of bird species and total bird density. The Species table (described in Table 2) contains the detailed bird census data (14,774 records) for each plot. The Species and Plots tables are linked by the record number field (RECNO).

Geographical Distribution

The 928 records in the database represent 640 unique census plots. Plots are located in 9 of the 10 provinces (none from Prince Edward Island) and in all 3 territories. The census plots are located in 76 of Canada's 217 ecoregions and 75 different habitat types. Figure 1 maps the distribution of census plot locations and Table 3 provides descriptive statistics by province. Most of the plots are located in Ontario (262, 40.9%) concentrated in the southern and south-central portion of the province. The Yukon has the fewest plots (N = 4).

Ecoregion Distribution

An ecoregion is a subdivision of an ecozone characterised by distinctive landforms, climates, vegetation, soils, water and regional human activity patterns/uses (Ecological Stratification Working Group, 1995). The addition of this variable may permit comparisons between plots of similar habitat within an ecoregion and potentially allow the prediction of bird densities.

Census plot sites are found in 76 of the 217 Canadian ecoregions (Table 4). Due to inaccurate latitude and longitude measurements, 7 census plots have not been assigned an ecoregion. The two best-represented ecoregions in the database are the Lake Erie Lowland ecoregion (N=84) and the Manitoulin-Lake Simcoe ecoregion (N=78).

Temporal Distribution

The number of censuses began to increase in the mid-1960's, a trend that continued until 1978 when a high of 83 censuses were performed. There was a sharp down-turn in the number of plots censused in 1983 with seldom more than 10 plots per year surveyed between then and 1993 (Figure 2). The reason for this dramatic decline in census activity is not known. Perhaps the rapid increase in the popularity of the less labour-intensive Breeding Bird Survey (BBS) is a factor. *American Birds* stopped publishing census results in 1984, which may have contributed to the perception that census data were not being used.

The CBBC database is dominated by sites which have been sampled only once (Table 5). Only 140 sites (21.9%) were sampled more than once, and only 56 (8.8%) were sampled more than twice. However, one Ontario site located in a wooded Toronto ravine (Moore Park Ravine) was sampled for 15 years.

Habitat

An important feature of the Canadian Breeding Bird Census Database is the habitat data associated with each census plot. In addition to recording the most prevalent vegetation species in different layers (3 canopy, 2 shrub and 2 ground cover) a hierarchical habitat classification scheme (Appendix I) was developed by A.J. Erskine based on his extensive knowledge of Canadian forest habitats. The scheme expands from 5 basic categories (broad-leafed forest, conifer and mixed forest, wetland, open land, and urban

areas) to allow the use of both complete and fragmentary habitat data. Vegetative structure rather than composition is used to reflect the assumption that birds respond principally to structure. Geographic subdivisions are included because bird communities are not identical in similar habitats across the country. Much of the subdivision in the classification relates to forest areas (A.J. Erskine, pers. comm.). Although over 50 habitat categories are described, any region would likely have less than that many. This habitat scheme was designed to combine convenience and usefulness; more precise habitat descriptions could be applied.

Primary and secondary habitat codes were retroactively assigned by Erskine based on habitat information provided in the published studies. In all, 609 census plots were assigned a primary habitat code (described in Appendix I) and 402 were assigned a secondary habitat. Thirty-one plots were not assigned a primary habitat code because of inadequate habitat descriptions, or because the plot size was small (<4 ha). In some cases, plots that were resurveyed after several years appeared to have undergone habitat succession, resulting in an altered habitat code. In other situations, subsequent observers estimated the percentage of primary and secondary habitats differently, resulting in more than one primary habitat code for the same plot. Note: because of duplicate habitat codes, the total number of primary and secondary habitat codes listed in Table 6b are 617 and 426 respectively, and the number of plots in Table 6a and Table 10 total 648, rather than 640. Where provided, "percent cover" refers to the percentage of total plot area covered by the primary or secondary habitat within the plot. Secondary habitat codes are not assigned if the percent cover is less than 5%.

Distribution of the data by habitat type appears in Figure 3 and Table 6a and are summarised further in Table 6b. The censuses are reasonably evenly distributed across the broad-leafed forest, conifer/mixed forest, and the open land habitats. Relatively fewer censuses have been done in wetland and urban habitats.

Bird Species

The database contains records for 263 species of birds. Table 7 lists the twenty-five bird species with the highest "occurrence rate" (number of censuses in which the species was present). Provincial statistics for total density (birds/100 ha) and total number of species are provided in Table 8. Table 9 shows the number of species and the average species density across ecoregions, while those for primary habitats are summarised in Table 10.

Conclusion

The labour-intensive methodology and relatively low participation rate make it unlikely that the BBC will be used to monitor population trends over large geographic areas. It does, however, provide site-specific population tracking and other useful data on bird populations. The extended coverage of each census plot establishes a reliable picture of the continued presence and breeding activity of birds in areas of known habitat. Censuses provide accurate and inclusive lists of all resident bird species on a plot during the breeding season (Erskine 1993). Although line-counts and point-counts, more suited to large areas, have replaced the "mapping method" as a tool for population monitoring, the BBC provides density measurements and comprehensive habitat information not measured by those surveys.

The relative scarcity of on-going or planned census studies in Canada may mean that this data set will not grow much in the near future. The Canadian Breeding Bird Census database represents a useful record of bird population information in Canada for the years 1929 to 1993.

If you would like to contribute new data to the database, or have comments on this site, please contact:

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Canadian Wildlife Service
Environment Canada
Ottawa, Ontario K1A 0H3
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Table 1: A description of the fields in the PLOTS table of the Canadian Breeding Bird Census Plot database (modified from Fritz 1996).

FIELD	DESCRIPTION
RECNO	Record Number - a unique 5-digit identifier assigned to each record. RECNO links plot records in the PLOTS table with data for individual species for that record in the SPECIES table. The first 2 digits always specify the year of census.
SITEID	Site Identification Number - a 5-digit identifier assigned to each new census plot. The numerical province codes used in the Canadian Geographical Names Database established by the National Atlas Information Service, Geomatics Canada, comprise the first 2 digits of SITEID, and allow sorting by province. The next 3 digits are assigned to new plots on order of entry. A plot censused over several years will have the same SITEID for all years. The 2-digit province codes (and abbreviations) are: 10 NF Newfoundland 11 PE Prince Edward Island 12 NS Nova Scotia 13 NB New Brunswick 24 QC Quebec 35 ON Ontario 46 MB Manitoba 47 SK Saskatchewan 48 AB Alberta 59 BC British Columbia 60 YT Yukon Territory 61 NT Northwest Territories 62 NU Nunavut
YEAR	Year of Census - specifies year in which census data were collected as a 4-digit number.
PLOTNAME	Plot Name - alpha-numeric description used to distinguish among individual plots in cases where a single article provides data for more than one plot. PLOTNAME is usually provided to some extent in the source, if necessary, to distinguish among plots.
FIRSTYR	First Year - specifies first year in which plot was censused as a 4-digit number. When compared with YEAR, this field identifies plots that have been censused previously.
COMPILL	Compiler's Last Name - identifies the person who took responsibility for compiling and publishing data given in the record. For cases in which a compiler was not specified, this name specifies the senior author. In cases where more than one person is cited as author, full authorship is given in the CITATION field (see below).
COMPILF	Compiler's First Name (or initial).
COMPILM	Compiler's Middle Initial(s).
PUBYEAR	Publication Year - specifies the year, as a 4-digit number, in which the data source was published.
PUBCENS	Publication Census Number - specifies the number, assigned by a journal, that immediately precedes the title of published census articles.

FIELD		DESCRIPTION
		This field will be blank for all unpublished sources, and for articles published in journals other than AFN, AB, and JFO (see JOURNAL)
TITLE		Title of data source - if absent from this field, information should be available in the CITATION field.
CITATION		Citation for the data source - for published censuses, this field credits all authors in the order given in the publication. For unpublished sources, this field contains all relevant information not found in other related fields (e.g. full authorship if more than one author, agency for which the material was prepared, page length of the source).
JOURNAL		Name of Journal (abbreviated) in which census data were published. The abbreviations used for the main journal sources are:
	AB	American Birds
	AFN	Audubon Field Notes
	ARC	Arctic
	AUD	Audubon Magazine
	BJ	BlueJay
	CFN	Canadian Field-Naturalist
	CJZ	Canadian Journal of Zoology
	CWSOP	Canadian Wildlife Service Occasional Papers
	Ecology	Ecology
	ForChro	Forest Chronicle
	JFO	Journal of Field Ornithology
	Murre	Murrelet
	NSB	Nova Scotia Birds
	NatCan	Naturaliste canadien
	OFB	Ontario Field Biologist
	Tchebec	Tchebec
VOLUME		Volume Number - of the journal in which the census data were published. In cases where the issue number of a volume is known, it is given here, separated from the volume number by a decimal point (e.g. 23.2 represents issue No.2 of volume 23).
PAGES		Page reference for the article from which the census data were taken. This field is used mainly for journal articles. Page references for unpublished reports, theses, etc. are usually entered in the CITATION field.
LANGUAGE		Language in which the source of data was written, specified by a 1-letter code: E=English, F=French.
PARTIC		Participants - specifies whether anyone other than the compiler or first author participated in the census with a 1-letter code: Y=Yes, N=No.
REMARKS		Specifies whether the source includes remarks about the census plot or census results with a 1-letter code: Y=Yes, N=No.
PROVINCE		Province or territory in which the census was taken, specified with a 2-letter code (see SITEID, above).
COUNTY		Name of county, district, region, municipality or other administrative jurisdiction in which the census was taken. The type of jurisdiction is often abbreviated here (e.g. Co=County, Dist=District).
CITYTOWN		Name of city, town or other geographic entity near to the census plot.

FIELD	DESCRIPTION
LAT_N	Latitude North of the Equator, of a point on the plot, or of the nearest identifiable geographic entity (often CITYTOWN), given in the form DD.MM.SS (degrees. minutes. seconds). Latitudes given in the source were entered as given. For cases where latitude was not given, secondary sources (maps, geo-reference databases) were consulted to obtain approximate latitude.
LONG_W	Longitude West of Greenwich, of a point on the plot, or of the nearest identifiable geographic entity (often CITYTOWN), given in the form DDD.MM.SS (degrees. minutes. seconds). Longitudes given in the source were entered as given. For cases where longitude was not given, secondary sources (maps, geo-reference databases) were consulted to obtain approximate longitude.
LOCATION	Supplementary information that may help locate the census plot on a map or in the field. May include references to diagrams in the source, route directions, landmarks, and distances (in meters or km). Distances given in feet or miles were converted based on 1 mile=1609.3 m (1.6 km).
MAPNO	National Topographic Service (NTS) Map Number - specifies the map that depicts the area in which the plot is situated; given as an alpha-numeric reference, often preceded by a place name (e.g. Ottawa 31G/4). Map resolution varies from 1:50,000 to 1:250,000.
GRIDREF	Grid Reference - specifies approximate geographic co-ordinates of some point within the plot (e.g. NW corner) or nearby geographic entity (often CITYTOWN); given in Universal Transverse Mercator (UTM) co-ordinates, unless specified otherwise.
PLOTSIZE	Plot Size - given in hectares (ha). When the source gave plot size in acres, conversion to hectares was based on 1 acre=0.405 ha.
MINELEV	Minimum Elevation - given in meters (m). When the source gave elevation in feet, conversion to meters was based on 1 foot=0.305 m. In many cases, elevation was assumed to be relative to sea level (0 elevation) unless the context suggested some other baseline.
MAXELEV	Maximum Elevation (m) - as above.
VISITS	Specifies the number of census-taking visits to the plot. Equivocal statements in sources were translated as the minimum number of visits apparent (e.g. '10-12 visits' was entered as '10'; 'at least 8 visits' and '10 or more visits' were entered as '8' and '10' respectively).
FIRSTVIS	First Visit - specifies the date of the first census-taking visit to the plot as a 4-digit number in the form MMDD, where the first 2 digits specify the month, and the last 2 digits specify date (e.g. 0621=Jun 21). The dates in data transferred from CLO were expressed as Julian dates that were converted to standard Gregorian calendar dates here. For cases where dates were not clearly expressed in the source (e.g. "Censuses were usually carried out weekly throughout June and July"), best estimates were entered in this field, and may only refer to the month of the first census. When available, descriptive notes were included in the COMMENTS field. The estimated dates were based on the following: 'early' month: the 5th day of the particular month 'beginning' or 'first week of' month: the 7th day of the particular month

FIELD	DESCRIPTION
	'mid-'month: the 15th day of the particular month 'late' month: the 25th day of the particular month e) 'end of' or 'last week of' month: the 30th of the particular month
LASTVIS	Last Visit - specifies the date of the last census-taking visit to the plot as a 4-digit number in the form MMDD (see FIRSTVIS).
HOURS	Specifies the total number of person-hours of observation, not including plot set-up or vegetation survey.
TOTSPP	Total Species - specifies the total number of bird species observed breeding on the plot, or for which the plot comprised part of a breeding territory.
TOTDENS	Total Density - specifies the total density of all species of breeding birds observed on the plot per 100 ha (km^2). Densities given in sources as no./100 ha or no./km^2 were usually entered as given. However, density was often reported in some other unit area (e.g. acres, 40 ha), and so had to be converted. Discrepancies occur between the sum of individual species densities (in THE SPECIES TABLE) and the total density reported in THE PLOTS TABLE because of rounding of fractional densities. The recommended protocol for calculating density per 100 ha is: Calculate the metric equivalent of plot area in hectares, if necessary. Calculate density per 100 ha for each species as: {Plot (raw) density divided by plot size (ha)} multiplied by 100) c) Sum species densities to get total density per 100 ha for the plot.
HABNAME	Habitat Name - a descriptive name for the census plot used in the CWS Progress Notes. It often corresponds with the title given in the data source, especially for articles published in American Birds.
HABCODE1	Habitat Code (Primary) - a numeric code developed by A.J. Erskine that specifies the primary habitat of the census plot. See Appendix I.
FRACTION1	Fraction 1 - a percentage cover of the primary habitat.
HABCODE2	Habitat Code 2 - a numeric code that specifies the secondary habitat of the census plot. The secondary habitat code is not given if its percentage cover is less than 5%.
FRACTION2	Fraction 2 - a percentage cover of the secondary habitat.
HABMEMO	Habitat Memo - detailed information on habitat codes, and additional information on other habitat types present in heterogeneous plots.
PNNO	Progress Notes Number - number specifying the particular issue of CWS Progress Notes in which the census is cited. There are 5 issues: Nos. 20, 30, 59, 112, and 144.
PNREF	Progress Notes Reference Number - number specifying the particular citation relevant to the census. References are numbered sequentially in the Progress Notes, from 1 in PN 20, to 381 in PN 144.
Vegetation Data	The following fields contain information on the composition of vegetation found on the plot as described or quantified in the data source. 8-letter codes are used throughout: the first 4 letters specify genus, the last 4

FIELD	DESCRIPTION
	specify species, if known (e.g. PINUSTRO=Pinus strobus, White Pine). Note that this information may not be present in all records.
CANOPY1	Most dominant canopy species.
CANOPY2	Second-most dominant canopy species.
CANOPY3	Third-most dominant canopy species.
SHRUB1	Dominant shrub species.
SHRUB2	Second-most dominant shrub species.
GROUND1	Dominant ground cover species. Note that some cases may only provide generic names for ground vegetation (e.g. GRASSES or MOSS).
GROUND2	Second-most dominant ground cover species.
STANDAGE	Age of the stand in years. A virgin stand is represented by 9999. Missing values are left blank.
VEGDATA	Vegetation Data - specifies whether a detailed vegetation survey had been conducted in the current census year with a 1-digit code: Y=Yes, N=No.
WATER	Specifies whether any body of water was present in the plot with a 1-letter code: Y=Yes, N=No. Types of bodies of water represented here include: lake, pond, pool, river, stream, creek, marsh, swamp, bog, muskeg, fen, slough.
ENTRYBY	Data Entry By - initials of the individual responsible for data entry for the record.
COMMENTS	Any potentially useful information not already included in other fields. Items here are numbered consecutively within each record for emphasis. Typical comments include, but are not limited to the following examples: 1) citation of a previously published plot description, 2) brief description of plot landscape, 3) descriptive statements relating to census dates or number of visits that were not explicitly given in the source, 4) identifying questionable data
ECOREGION	Ecoregion of Canada applicable to the given plot. An ecoregion is an area characterized by distinctive regional ecological factors, including climate, physiography, vegetation, soil, water, fauna and land use.
REGION	A numeric code that specifies the ecoregion of the given census plot.

Table 2: A description of the fields in the SPECIES table of the Canadian Breeding Bird Census Plot database (modified from Fritz 1996).

FIELD	DESCRIPTION
RECNO	Record Number - identical to that described for the PLOTS table above.
COMNAME	Common Name - full common name (in English) of the species, as given in the 1998 AOU checklist. Every attempt has been made to standardise usage, but some discrepancies due to revised classification may occur.
GENUS	Taxonomic Name - Genus (if known), mainly as given in the 1998 AOU checklist.
SPECIES	Taxonomic Name - Species (if known), mainly as given in the 1998 AOU checklist.
AOU	American Ornithologists' Union Species Number, if known.
CODE	Species Code - 4-letter code for the species, of the form GGSS. In most cases, GG represents the first 2 letters of the genus, and SS represents the first 2 letters of the species epithet. These codes were developed by the North American Bird Banding Scheme.
DENSKM2	Density per 100 ha - the standardised density for the species. Densities reported in other units of area (e.g. pairs/100 acres, or pairs/40 ha) were converted using metric equivalents as previously described. Some discrepancies occur between the total density given in a data source and the sum of individual species densities for the same plot due to rounding of fractional densities to whole numbers, and in some cases due to small plot size. Standardised densities were not calculated for species densities given as '+', but are entered in this field as 0.1. Note that the count of all species with data in this field (or with the same RECNO) should be the same as the value present in the TOTSPP field in the PLOTS table. Likewise, the sum of species densities for a given RECNO should be the same as the value present in the TOTDENS field in the PLOTS Table. Some allowable exceptions occur due to rounding errors.
PLOTDENS	Plot Density - the actual count or 'raw' density of each breeding species observed on the plot. In most cases this value was given in the data source. The density of species with only part of their territory on the plot was usually given as '+' in data sources. This was interpreted as a density of at least 0.1, and was entered into the database as such. In revised records, plot densities not given in the source are indicated with -999. This field was added later to allow greater precision in calculating density per unit area (see DENSKM2 below). The plot size is implied as the unit area to which PLOTDENS relates.
TAXON	Taxonomic Name - Genus and species (if known), as given in the data source.
RPTNAME	Report Name - Common name of the species as given in the data source if different from the COMNAME described above.

Table 3: Summary of descriptive statistics for the census plots by province.

Province	Total Plots	Total Censuses	Plot Size* Mean	Plot Size* Range	Visits Mean	Visits Range	Hours Mean	Hours Range
Newfoundland	11	11	17	6-40	9	6-11	18	11-26
Nova Scotia	37	42	6	2-12	10	6-21	23	11-44
New Brunswick	42	46	16	4-51	11	6-28	36	16-124
Québec	60	88	12	4-70	10	5-130	32	3-101
Ontario	262	421	11	0.2-53	10	2-74	25	2-117
Manitoba	52	82	12	4-36	7	2-11	24	8-46
Saskatchewan	15	36	18	11-23	21	8-94	72	25-200
Alberta	74	95	16	2-80	9	5-13	22	5-50
British Columbia	57	65	15	2-35	11	5-23	22	6-79
Yukon Territory	4	4	33	32-37	7	6-7	-**	-**
Northwest Territories	13	13	39	6-256	7	2-13	21	16-138
Nunavut	13	25	1371	73-5260	0.2	2-3	82	25-250
Total	**640**	**928**						

*Plot size in hectares **Not provided

Table 4: Number of census plots per ecoregion (640 plots).

Ecoregion	Plots	Ecoregion	Plots
	7*		
Ellesmere and Devon Island Ice Caps	2	Maritime Lowlands	6
Eureka Hills	1	Fundy Coast	32
Parry Islands Plateau	2	Southwest Nova Scotia Uplands	11
Borden Peninsula Plateau	1	Annapolis-Minas Lowlands	1
Melville Peninsula Plateau	1	South-Central Nova Scotia Uplands	2
Foxe Basin Plain	3	St. Lawrence Lowlands	38
Meta Incognita Peninsula	2	Frontenac Axis	3
Yukon Coastal Plain	5	Manitoulin-Lake Simcoe	78
Tuktoyaktuk Coastal Plain	2	Lake Erie Lowland	84
Maguse River Upland	2	Slave River Lowland	9
Norman Range	1	Peace Lowland	3
Great Slave Lake Plain	2	Wabasca Lowland	7
Hay River Lowland	7	Western Alberta Upland	12
Muskwa Plateau	1	Mid-Boreal Uplands	9
Tazin Lake Upland	1	Mid-Boreal Lowland	1
Selwyn Lake Upland	1	Interlake Plain	10
Churchill River Upland	5	Aspen Parkland	19
Hayes River Upland	2	Moist Mixed Grassland	14
Lac Seul Upland	3	Mixed Grassland	8
Lake of the Woods	6	Lake Manitoba Plain	8
Rainy River	1	Southwest Manitoba Uplands	1
Thunder Bay-Quetico	1	Coastal Gap	2
Lake Nipigon	11	Pacific Ranges	7
Big Trout Lake	3	Western Vancouver Island	7
Abitibi Plains	32	Eastern Vancouver Island	2
Lake Timiskaming Lowland	3	Georgia-Puget Basin	1
Algonquin-Lake Nipissing	37	Lower Mainland	6
Southern Laurentians	13	Skeena Mountains	1
Riviere Rupert Plateau	1	Central Canadian Rocky Mountains	1
Mecatina Plateau	1	Fraser Plateau	4
Southwestern Newfoundland	4	Fraser Basin	1
Central Newfoundland	3	Columbia Mountains and Highlands	3
Northeastern Newfoundland	2	Western Continental Ranges	2
Maritime Barrens	1	Eastern Continental Ranges	23
Appalachians	20	Thompson-Okanagan Plateau	1
Northern New Brunswick Uplands	9	Southern Rocky Mountain Trench	1
Saint John River Valley	2	Northern Continental Divide	5
Southern New Brunswick Uplands	10	Coastal Hudson Bay Lowland	6

* Due to inaccurate latitude and longitude measurements, 7 census plots have not been assigned an ecoregion.

Table 5: A frequency distribution of plot censuses by number of years (for 640 plots).

Number of Years	1	2	3	4	5	6	7	8	9	10	12	15
Censuses	500	84	20	17	10	2	1	1	2	1	1	1

Table 6a: Number of census plots per primary habitat type (640 plots).

Primary Habitat		Code	Plots
Broad-leafed forest/woodland			
Indeterminate			
	Mature	101	3
	Young	103	5
	Disturbed	104	5
Poplar/Paper Birch/Willow/Alder			
	Mature	111	21
	Mid-Age	112	40
	Young	113	13
	Disturbed	114	8
Maple/Beech/Yellow Birch			
	Mature	121	38
	Mid-Age	122	13
	Young	123	4
Silver Maple/American Elm			
	Mature	131	2
Red Oak/Other Eastern Oak;			
		140	1
	Mature	141	13
	Mid-Age	142	5
	Disturbed	144	2
Bur Oak/Green Ash/Manitoba Maple			
	Mature	151	2
	Mid-Age	152	2
Wetlands			
Shallow fresh marsh		313	16
Shrubby Swamp		314	7
Swamp forest		315	4
Fen		321	1
Wet Bog		322	7
Dry Bog		323	7
Riparian Sand and Gravel		331	7
Riparian shrubbery		332	2
Open Land			
Arctic tundra "desert"		411	7
Arctic tundra "oasis"		412	12
Alpine tundra		413	5
Tundra/forest shrubland;		414	5
Short-grass prairie		421	15
Long-grass prairie		422	2
Prairie Grassland (unmowed)		423	1
Prairie grassland		424	4
Prairie/forest shrubland;		425	1
Cropland		431	3
Fallow		432	4
Hay field or pasture		433	14
Old field		434	27
Clear-cuts 1-2y after cutting;		441	10
Clear-cuts 3-7 y - natural		442	23
Clear-cuts 3-7 y - planted		443	5

Primary Habitat		Code	Plots
Conifer and mixed forest/woodland			
Indeterminate			
		200	1
	Mature	201	2
	Mid-Age	201	1
Black/White/Red Spruce			
	Mature	211	13
	Mid-Age	212	25
	Young	213	16
	Disturbed	214	2
Balsam Fir			
	Mature	221	17
	Mid-Age	222	19
	Young	223	2
	Disturbed	224	5
Eastern Hemlock/Cedar/Pine			
	Mature	231	16
	Mid-Age	232	14
	Young	233	2
Tamarack/Black Spruce;			
	Mature	241	1
	Mid-Age	242	7
	Young	243	3
Jack Pine/Lodgepole Pine;			
	Mature	251	2
	Mid-Age	252	17
	Young	253	6
Douglas-Fir/Lodgepole Pine;			
	Mature	261	4
	Young	263	1
	Disturbed	264	1
Englemann Spruce/Subalpine Fir			
	Mature	281	2
	Mid-Age	282	3
	Young	283	1
	Disturbed	284	1
Western Hemlock/Red Cedar			
	Mature	291	8
	Mid-Age	292	5
	Young	293	1
	Disturbed	294	1
Urban Area			
Urban park		510	11
Urban built-up		520	34
Urban "desert"		530	7

Table 6b: Number of habitat codes assigned to census plots listed by general habitat category.

Habitat type	Primary Habitat (No. of plots)	Secondary Habitat (No. of plots)
Conifer/mixed forest	177	197
Broad-leafed forest	199	129
Open land	51	50
Wetlands	138	40
Urban areas	52	11
Total	**617**	**427**

Table 7: The twenty-five bird species with the highest occurrence rate* (928 censuses).

Bird Species	Number of Occurrences
American Robin	454
Red-eyed Vireo	362
Black-capped Chickadee	314
White-throated Sparrow	306
Song Sparrow	295
Dark-eyed Junco	274
Northern Flicker	271
Ovenbird	259
Chipping Sparrow	251
Brown-headed Cowbird	251
Yellow-rumped Warbler	249
Blue Jay	249
Red-winged Blackbird	228
European Starling	226
Eastern Wood-Pewee	225
Swainson's Thrush	218
Rose-breasted Grosbeak	214
Common Grackle	214
Baltimore Oriole	213
Common Yellowthroat	212
Great Crested Flycatcher	207
Black-and-white Warbler	186
Cedar Waxwing	177
Hermit Thrush	177
Veery	174

*Occurrence rate is the number of censuses in which the species was present.

Table 8: Summary of bird statistics by province (640 plots).

Province	Total Species Mean	Total Species Range	Total Density Mean	Total Density Range
Newfoundland	16	3-25	516	24-1587
Nova Scotia	15	7-28	694	132-1205
New Brunswick	17	5-33	534	62-1245
Québec	15	3-47	449	37-1000
Ontario*	19	1-49	657	21-3765
Manitoba	15	5-29	391	35-2200
Saskatchewan	10	4-19	207	77-389
Alberta	13	1-38	226	6-923
British Columbia	15	2-35	352	34-1419
Yukon Territory	9	4-11	143	111-161
Northwest Territories	11	7-21	233	45-576
Nunavut	14	5-22	58	5-343

*One site sampled in Ontario in 1963, 1964 and 1970 has been removed for the purposes of this analysis. This site was a seabird colony on an island in Lake Ontario. The total bird density of one census was 277688 species per 100 ha.

Table 9: Summary of bird statistics by ecoregion (640 plots).

Ecoregion	Mean Total Species	Mean Species Density	Ecoregion	Mean Total Species	Mean Species Density
Ellesmere and Devon Island Ice Caps	12	13	Maritime Lowlands	23	495
Eureka Hills	12	5	Fundy Coast	13	653
Parry Islands Plateau	5	8	Southwest Nova Scotia Uplands	18	584
Borden Peninsula Plateau	13	45	Annapolis-Minas Lowlands	24	858
Melville Peninsula Plateau	16	39	South-Central Nova Scotia Uplands	18	694
Foxe Basin Plain	21	78	St. Lawrence Lowlands	19	524
Meta Incognita Peninsula	10	15	Frontenac Axis	25	727
Yukon Coastal Plain	9	139	Manitoulin-Lake Simcoe*	16	595
Tuktoyaktuk Coastal Plain	10	188	Lake Erie Lowland	18	670
Maguse River Upland	17	202	Slave River Lowland	18	321
Norman Range	9	55	Peace Lowland	23	308
Great Slave Lake Plain	9	168	Wabasca Lowland	19	290
Hay River Lowland	13	200	Western Alberta Upland	22	370
Muskwa Plateau	12	128	Mid-Boreal Uplands	16	293
Tazin Lake Upland	7	252	Mid-Boreal Lowland	10	146
Selwyn Lake Upland	21	207	Interlake Plain	15	354
Churchill River Upland	12	326	Aspen Parkland	17	356
Hayes River Upland	24	189	Moist Mixed Grassland	4	106
Lac Seul Upland	12	162	Mixed Grassland	7	164
Lake of the Woods	11	339	Lake Manitoba Plain	17	969
Rainy River	26	915	Southwest Manitoba Uplands	13	299
Thunder Bay-Quetico	11	311	Coastal Gap	18	485
Lake Nipigon	29	633	Pacific Ranges	16	495
Big Trout Lake	21	326	Western Vancouver Island	13	256
Abitibi Plains	18	840	Eastern Vancouver Island	28	473
Lake Timiskaming Lowland	8	428	Georgia-Puget Basin	33	291
Algonquin-Lake Nipissing	25	627	Lower Mainland	12	561
Southern Laurentians	15	294	Skeena Mountains	14	134
Riviere Rupert Plateau	9	63	Central Canadian Rocky Mountains	24	525
Mecatina Plateau	15	180	Fraser Plateau	22	404
Southwestern Newfoundland	13	497	Fraser Basin	28	785
Central Newfoundland	20	913	Columbia Mountains and Highlands	11	378
Northeastern Newfoundland	11	135	Western Continental Ranges	13	118
Maritime Barrens	25	500	Eastern Continental Ranges	7	111
Appalachians	16	695	Thompson-Okanagan Plateau	24	247
Northern New Brunswick Uplands	17	363	Southern Rocky Mountain Trench	18	219
Saint John River Valley	18	337	Northern Continental Divide	11	152
Southern New Brunswick Uplands	16	611	Coastal Hudson Bay Lowland	15	232

*One of the sites for this ecoregion has been removed for the purposes of this analysis. This site was a seabird colony on an island in Lake Ontario.

Table 10: Summary of bird statistics by primary habitat (640 plots).

Primary Habitat		Code	Mean Total Species	Mean Total Density
Broad-leafed forest/woodland				
Indeterminate				
	Mature	101	12	371
	Young	103	14	689
	Disturbed	104	19	485
Poplar/Paper Birch/Willow/Alder				
	Mature	111	21	443
	Mid-Age	112	19	417
	Young	113	24	641
	Disturbed	114	24	742
Maple/Beech/Yellow Birch				
	Mature	121	20	609
	Mid-Age	122	17	646
	Young	123	17	584
Silver Maple/American Elm				
	Mature	131	21	339
Red Oak/Other Eastern Oak;				
		140	28	445
	Mature	141	21	560
	Mid-Age	142	23	664
	Disturbed	144	40	843
Bur Oak/Green Ash/Manitoba Maple				
	Mature	151	21	691
	Mid-Age	152	14	1190
Wetlands				
Shallow fresh marsh		313	12	1017
Shrubby Swamp		314	14	548
Swamp forest		315	29	738
Fen		321	14	354
Wet Bog		322	11	174
Dry Bog		323	11	145
Riparian Sand and Gravel		331	9	340
Riparian shrubbery		332	7	346
		343	10	314
Open Land				
Arctic tundra "desert"		411	11	63
Arctic tundra "oasis"		412	11	104
Alpine tundra		413	5	75
Tundra/forest shrubland;		414	8	123
Short-grass prairie		421	6	159
Long-grass prairie		422	20	551
Prairie Grassland (unmowed)		423	3	43
Prairie grassland		424	7	141
Prairie/forest shrubland;		425	9	120
Cropland		431	7	110
Fallow		432	6	213
Hay field or pasture		433	8	221
Old field		434	24	604
Clear-cuts 1-2y after cutting;		441	12	298
Clear-cuts 3-7 y - natural		442	16	701
Clear-cuts 3-7 y - planted		443	9	381

Primary Habitat		Code	Mean Total Species	Mean Total Density
Conifer and mixed forest/woodland				
Indeterminate				
		200	34	464
	Mature	201	34	694
	Mid-Age	202	7	225
Black/White/Red Spruce				
	Mature	211	22	423
	Mid-Age	212	20	509
	Young	213	18	455
	Disturbed	214	17	920
Balsam Fir				
	Mature	221	27	595
	Mid-Age	222	21	735
	Young	223	13	486
	Disturbed	224	17	411
Eastern Hemlock/Cedar/Pine				
	Mature	231	20	514
	Mid-Age	232	16	645
	Young	233	14	660
Tamarack/Black Spruce;				
	Mature	241	12	316
	Mid-Age	242	15	327
	Young	243	16	321
Jack Pine/Lodgepole Pine;				
	Mature	251	14	229
	Mid-Age	252	8	128
	Young	253	11	260
Douglas-Fir/Lodgepole Pine;				
	Mature	261	22	571
	Young	263	8	350
	Disturbed	264	7	288
Englemann Spruce/Subalpine Fir				
	Mature	281	16	268
	Mid-Age	282	9	171
	Young	283	5	33
	Disturbed	284	28	785
Western Hemlock/Red Cedar				
	Mature	291	11	271
	Mid-Age	292	22	332
	Young	293	6	538
	Disturbed	294	20	852
Urban Area				
Urban park		510	14	400
Urban built-up		520	15	650
Urban "desert"		530	7	582

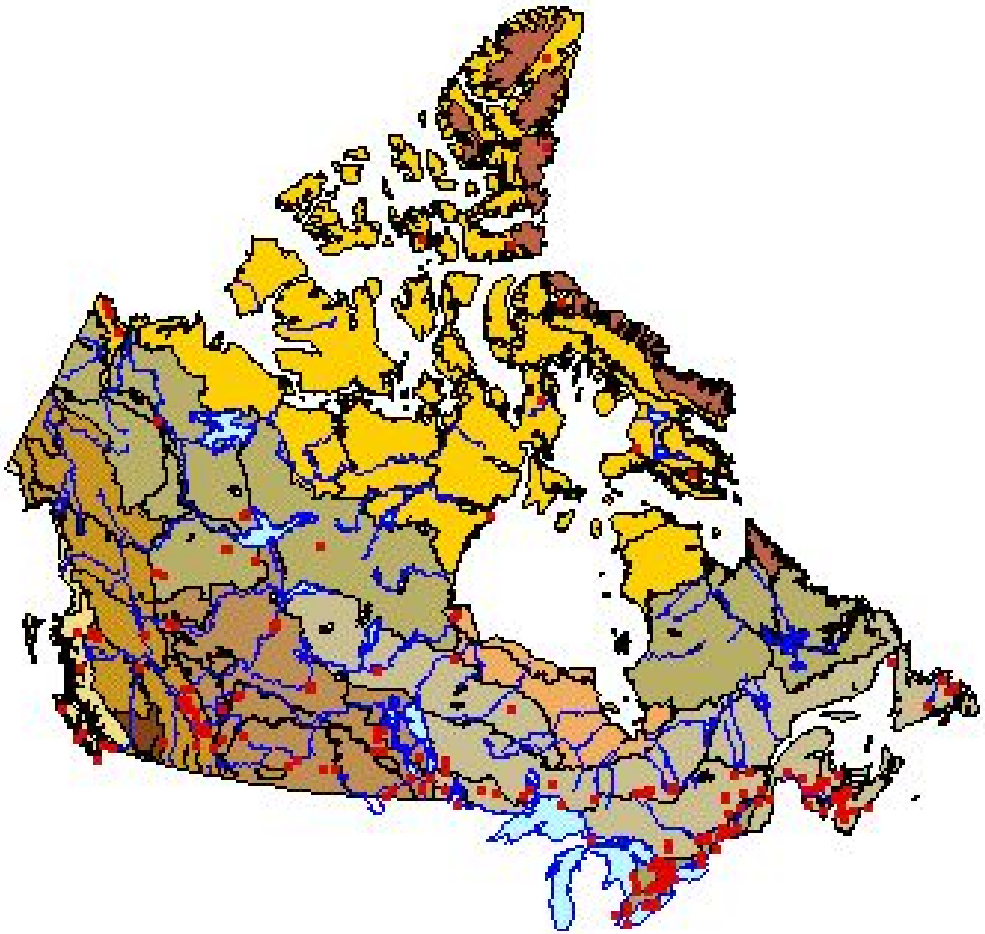


Figure 1: Map of census plot locations in Canada.

Figure 2: The number of census plots sampled per year (928 records).

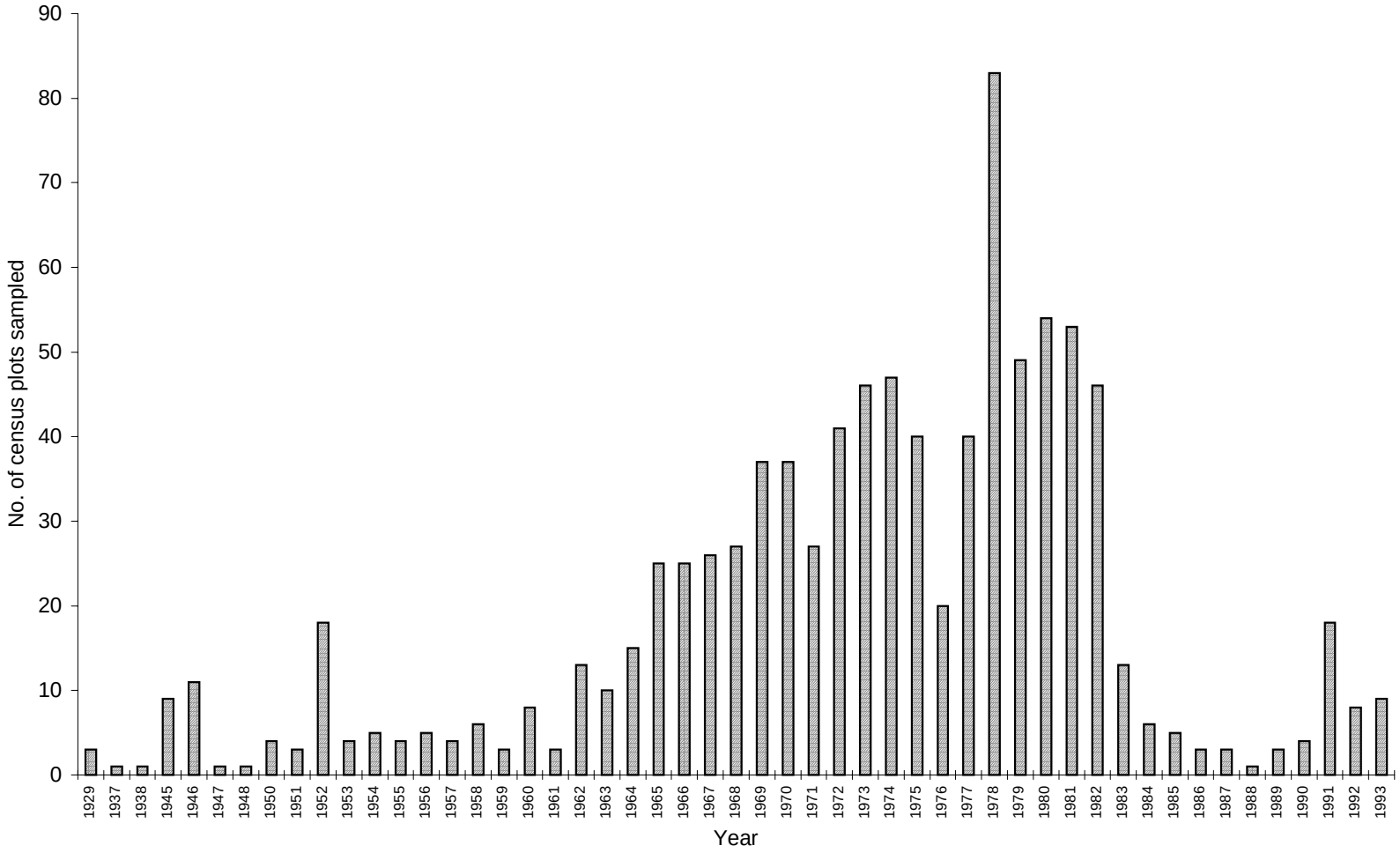
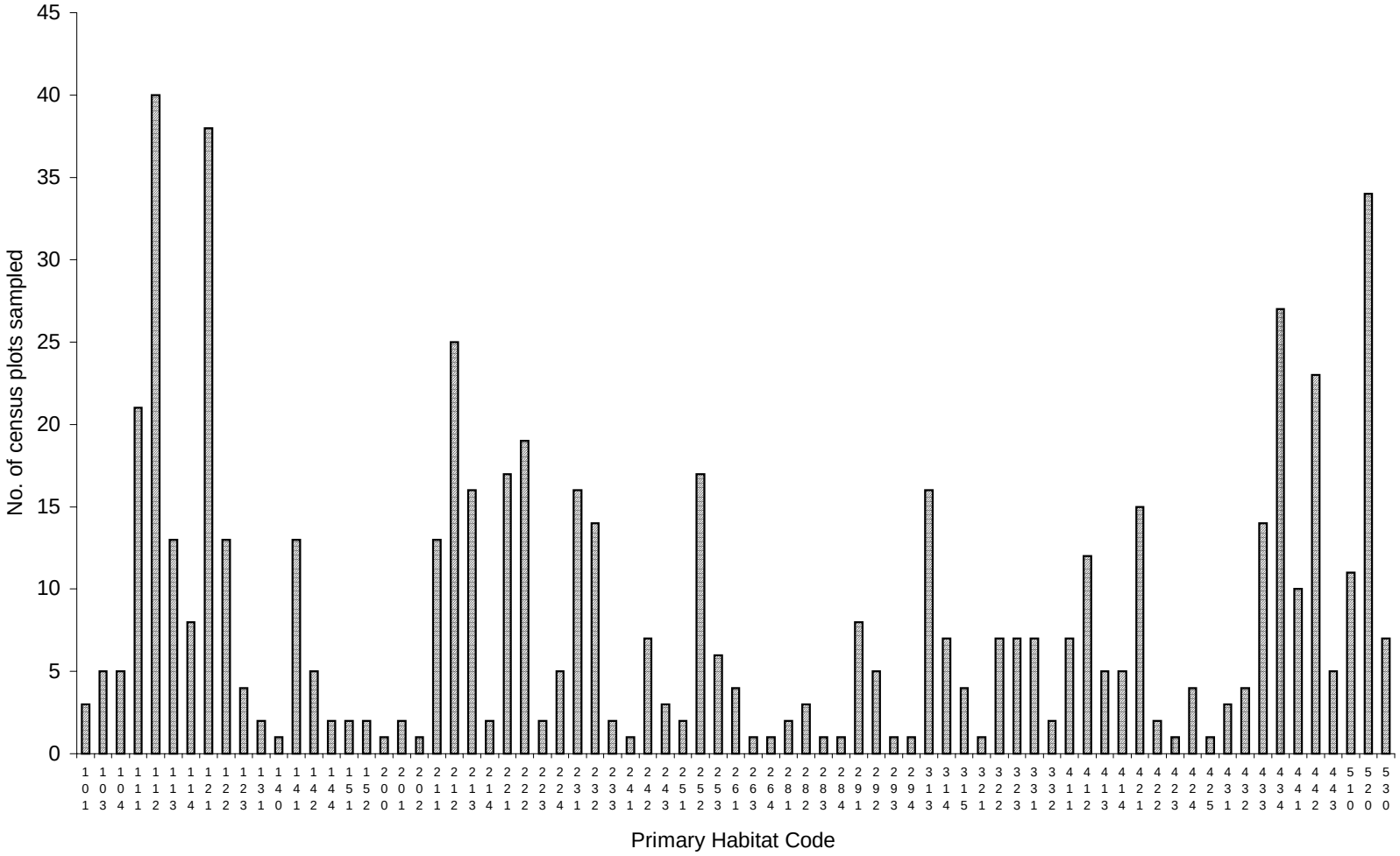


Figure 3: The number of census plots per primary habitat (N=640).



Appendix I: Habitat Classification for the Canadian Breeding Bird Census Plot Database.

100 Broad-leafed forest/woodland;
- **110** Poplar (s) and/or Paper Birch and/or willows and/or Speckled Alder;
  - **111** Mature (canopy height>=15m high);
  - **112** Mid-age (canopy height>=8m <15m);
  - **113** Young (canopy closed, >=4m < 8m high)
  - **114** Disturbed or cut-over (not clear-cut, but canopy <25% closed; height variable.
- **120** Sugar and/or Red maples and/or Beech and/or Yellow Birch;
- **130** Silver Maple and/or American Elm;
- **140** Red Oak or other eastern oaks with other broad-leafed tree species;
- **150** Bur Oak, Green Ash, Manitoba Maple, or some mixture including these species;
- **160** Broad-leafed Maple and/or Red Alder;

Categories 121, 122, 123, 124, 131, 132, 133, 134, etc. are assigned as per 111, 112, 113, 114

200 Conifer and mixed (<50% broad leafed) forest/woodland;
- **210** Black, White, or Red spruces (Balsam Fir minor or absent);
- **220** Balsam Fir, alone or with spruces;
- **230** Eastern Hemlock and/or White Pine or Red Pine, or Eastern White Cedar;
- **240** Tamarack, alone or with Black Spruce;
- **250** Jack Pine or Lodgepole Pine;
- **260** Douglas-Fir, alone or with Lodgepole Pine and/or Western Larch;
- **270** Ponderosa Pine, alone or with Douglas-Fir;
- **280** Englemann Spruce and/or Subalpine Fir, often with Lodgepole Pine;
- **290** Western Hemlock and/or Western Red Cedar and/or Mountain Hemlock;

Categories 211, 212, 213, 214 etc. are assigned as per 111, 112, 113, 114, etc.

300 Wetland;
- **310** Marshes and swamps;
  - **311** Saltmarsh;
  - **312** Deep fresh marsh (parts >2m depth);
  - **313** Shallow fresh marsh (all <2m depth), including weakly brackish marsh;
  - **314** Shrubby Swamp
  - **315** Swamp forest (see also 13.)

Categories 3151, 3152, 3153, 3154, as for 111, 112, 113, 114, etc…

- **320** Fens and bogs (peatlands);
  - **321** Fen
  - **322** Wet Bog (some standing water in pools or ponds);
  - **323** Dry Bog (no standing water; usually shrubby);
- **330** Riparian areas (along brooks, rivers and lakeshores);
  - **331** Sand, gravel and herbaceous cover;
  - **332** Riparian shrubbery

400 Open lands;

410 Tundra

411 Arctic tundra "desert"

412 Arctic tundra "oasis";

413 Alpine tundra;

414 Tundra/forest shrubland;

420 Prairie

421 Short-grass prairie (mainly on "third prairie level', native; may be grazed, but unmowed);

422 Long-grass prairie (mainly on "first prairie level", native; may be grazed, but unmowed);

423 Prairie grassland (introduced grasses; may be grazed, but unmowed);

424 Prairie grassland, mowed or burned;

425 Prairie/forest shrubland;

430 Farmland

431 Cropland;

432 Fallow;

433 Hay field or pasture (other than prairie);

434 Old field, starting to revert to shrubland;

440 Clear-cut forest land. <=7y after cutting;

441 Clear-cuts 1-2y after cutting;

442 Clear-cuts 3-7 y after cutting (natural regeneration);

443 Clear-cuts 3-7 y after cutting (planted for reforestation)

500 Urban areas

510 Urban park (except "natural parks" which group as forest, grassland, wetland, etc.);

520 Urban built-up (usually residential) with vegetated areas;

530 Urban "desert" (industrial or old mid-town residential, with little or no vegetation).

NOTES:

(i): The geographic location will be entered in the identification (ID) for each entry; thus, the biogeoclimatic zone may be determined from the ID, and is not repeated in this classification

(ii) Canopy heights for a given stand age/stage usually average 30-50% greater west of B.C. coast mountains.

(iii): Under both 100 and 200 , some stands are dominated by tree species other than those listed; such cases are few and unusual, so they are grouped with the most similar category, with an explanatory entry under “Notes”.

(iv): Because many forest stands include more than one distinct habitat, and some bird species occur in response to these minor but distinctive components of the forest cover, a second habitat type is identified wherever one is easily recognizable from the description. The second habitat may be another forest type, or an open or wetland habitat within, and censused along with, the main habitat. If a third distinct habitat is present, which explains the presence of some birds, this is entered under “Notes”.

(v): Early successional areas in forest regions are grouped under 400, Open lands.

(vi): Natural, quasi-permanent, shrubby lands are placed in the system which gave rise to them, thus: 314. Shrubby swamp; 332. Riparian shrubbery; 414. Tundra/forest shrubland, etc.