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Canada

Canadian Ice Service Regional Ice Charts in SIGRID-3 Format, Version 2

Technical Report

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1. Dataset Overview

This dataset provides a long-term digital archive of Canadian regional ice charts produced by the Canadian Ice Service (CIS), encoded in the SIGRID-3 vector format. The dataset is intended as historical information on sea ice concentration and stage of development in a spatial format.

1.1 Dataset Contents and Key Variables

The dataset consists of weekly regional sea ice charts stored as polygon shapefiles and gifs of the original paper chart, when available. Each polygon represents a spatially homogeneous ice regime as interpreted by CIS analysts at the time of chart production. The charts encode sea ice information using internationally recognized coding systems, including the ratio code (used historically), and the egg code (currently used), and are digitized to the SIGRID-3 standard.

Key variables provided in the dataset include:

- Total sea ice concentration
- Partial ice concentrations by ice type
- Stage of development, which serves as a proxy for ice thickness
- Floe size
- Fast ice and strips-and-patches indicators, where applicable

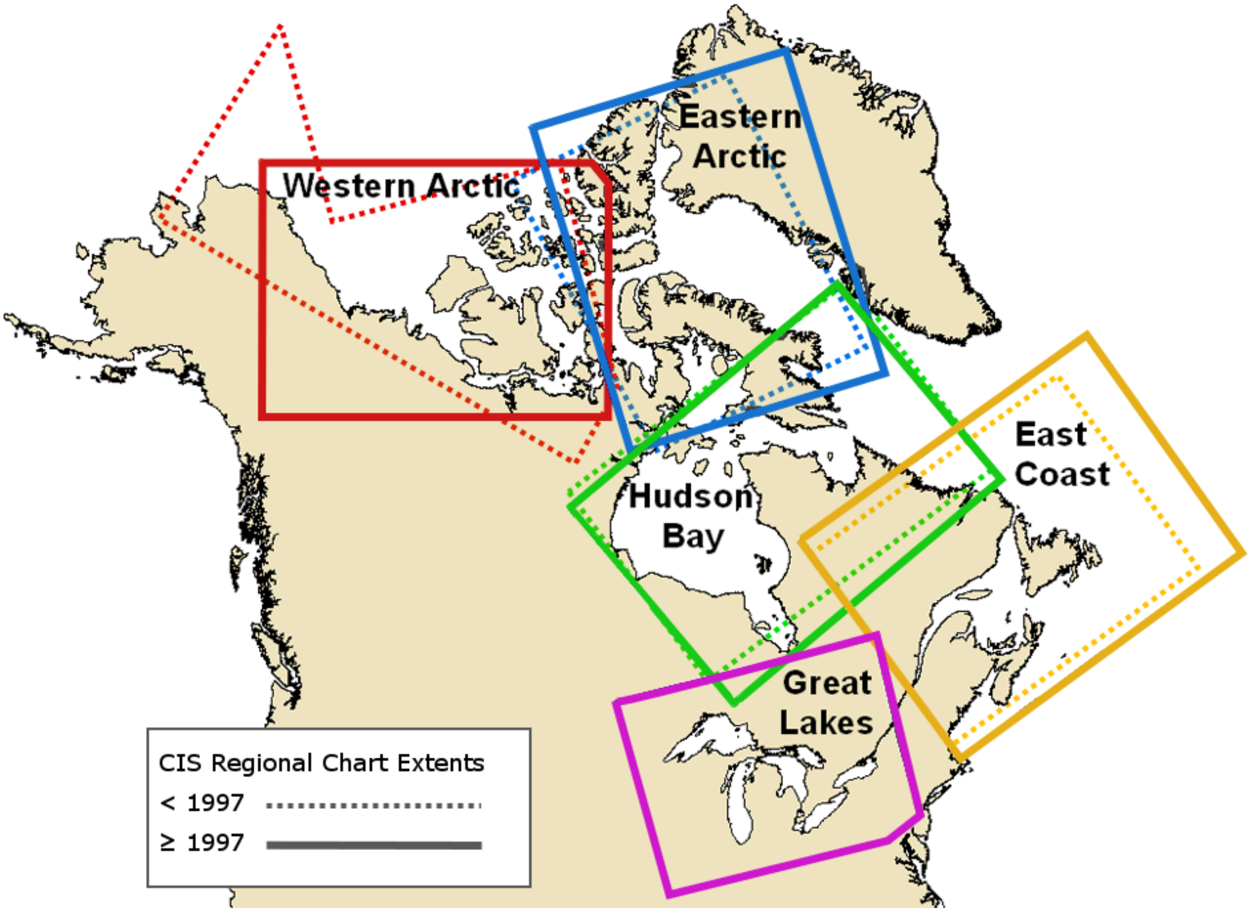
The dataset also includes internally derived numeric representations of ice concentration and type that are used by CIS for climatological calculations.

1.2 Spatial Coverage

The dataset covers Canadian waters in both the Arctic and southern regions:

- Eastern Arctic (EA)
- Western Arctic (WA)
- Hudson Bay (HB)
- East Coast (EC)
- Great Lakes (GL)

The spatial extent of some regions evolved over time as charting practices and operational requirements changed, except for the Great Lakes, whose coverage remained consistent throughout the record.



The charts are provided as vector shapefiles and therefore do not have an inherent spatial resolution. However, the original paper charts were produced at a nominal scale of approximately 1:4,000,000, which defines the effective level of spatial detail represented.

All charts are provided in a Lambert Conformal Conic projection. Charts in the archive prior to 2020 were produced using the North American Datum of 1927 (NAD27). Starting in 2020, charts use the World Geodetic System 1984 (WGS84) datum. The specific projection parameters and datum information for each chart are documented in the associated projection (.prj) file included with each shapefile.

1.3 Temporal Coverage

The dataset spans the period from 1968 to 2020, with the start date varying by region:

- Eastern Arctic: June 25, 1968
- Western Arctic: June 25, 1968
- Hudson Bay: June 21, 1971
- East Coast: November 26, 1968
- Great Lakes: December 20, 1972

Regional sea ice charts are produced on a weekly schedule. Each chart is dated using the Monday of the chart week and represents ice conditions over an approximately seven-day period centered on that date. Charts are finalized and issued later in the week, typically on Wednesday, based on satellite imagery and observational data collected over several days surrounding the nominal chart date.

To enable consistent comparison across years, each chart is also assigned a standardized Historical Date (HD), corresponding to a fixed weekly position within the calendar year. This convention facilitates climatological analyses by aligning charts from different years despite variations in calendar dates.

Chart production was not continuous in the early record, and not all weeks are represented for all regions. A complete inventory of available chart dates by region is provided in Appendices D through H.

2. Dataset Scope and File Organization

2.1 File and Directory Structure

The dataset is distributed as a collection of compressed archive files organized by region. At the top level, the directory structure consists of five regional folders:

- Eastern_Arctic
- Western_Arctic
- Hudson_Bay
- East_Coast
- Great_Lakes

Individual zip files correspond to weekly ice charts. Each zip archive contains:

- A polygon shapefile representing the regional ice analysis
- Associated projection and attribute files
- An XML metadata file
- An image of the original published ice chart in gif format, where available

In the event of a discrepancy between the polygon shapefile and the original published chart in gif format, the original chart in gif format takes precedence.

2.2 File Naming Convention

All files follow the following naming convention that encodes the region and chart date:

CIS_RXX_YYYYMMDD_pl_a.zip

where:

- RXX is the two-letter region code
    - EA: Eastern Arctic

- WA: Western Arctic
- HB: Hudson Bay
- EC: East Coast
- GL: Great Lakes

- YYYY is the four-digit year
- MM is the two-digit month corresponding to the chart's historical date
- DD is the two-digit day corresponding to the chart's historical date
- pl indicates polygon features
- _a refers to original issue vs correction (subsequent corrections use the letters b, c, etc. in place of a)

Within each archive, standard shapefile components (.shp, .shx, .dbf, .prj) share the same base filename, along with the associated metadata and chart image files.

2.3 File Size and Data Volume

Individual zip files range in size from approximately 0.1 MB to 4 MB, depending on region, spatial complexity, and the number of polygons present in the chart.

2.4 Fields Included in the Files

Each shapefile contains a standardized set of attributes describing sea ice conditions within each polygon. These attributes include coded representations of total ice concentration, partial concentrations by ice type, stage of development, floe size, along with internally derived numeric equivalents.

The specific fields present in a given file depend on the charting era and coding system in use at the time of production. Charts from the ratio-code era include both ratio-code and converted egg-code fields, while charts from the egg-code era omit ratio-code attributes. Detailed descriptions of all fields, their domains, and interpretation are provided in Appendices A and B.

3. Ice Chart Production

Canadian Ice Service regional sea ice charts are produced through an expert synthesis of multiple observational data sources and environmental context. The primary observational input is satellite imagery, which has evolved over time. Data sources include optical sensors and routine use of synthetic aperture radar (SAR) towards the second half of the archive. SAR imagery provides consistent coverage independent of cloud cover or daylight and forms the dominant data source for Arctic regions. In contrast, daily ice charts and in situ observations play a larger role in the Great Lakes and East Coast regions, where satellite coverage may be supplemented more frequently by direct reporting.

Ground-truth observations from Ice Service Specialists (ISS) aboard Canadian Coast Guard vessels and dedicated aircraft are incorporated when available. These in situ observations support interpretation of ice concentration, ice type, floe size, and stage of development.

Chart production is carried out through expert visual analysis by trained ice analysts following the standards defined in the *Manual of Standard Procedures for Observing and Reporting Ice Conditions* (MANICE) (Environment Canada, 2005). Analysts integrate observational data with relevant meteorological and oceanographic context, including air temperature, wind fields, ocean currents, tides, freezing degree day calculations, and climatological expectations for the time of year. A notable difference between the Great Lakes and the East Coast regional ice charts is the reliance on daily ice charts during production. The Great Lakes and East Coast regional charts are generated primarily from daily ice charts whereas the Arctic regional charts are generated primarily from satellite imagery with the daily ice charts used as guidance.

The analysis process involves delineating spatially homogeneous ice regimes and assigning standardized codes describing total ice concentration, partial concentrations by ice type, stage of development, and floe size. These attributes are encoded using recognized conventions to ensure consistency across regions and through time. Regional ice charts represent a best-estimate synthesis of ice conditions rather than direct instrumental measurements.

3.1 Weekly Chart Timing

Regional ice charts are produced on a weekly basis. Each chart is dated using the Monday of the chart week, representing ice conditions over an approximate seven-day period centered on that date. Charts are finalized and issued later in the week, typically on Wednesday. The exception is the East Coast regional, which is produced by copying the daily charts produced on Monday and generalizing the analysis.

During chart production, satellite imagery and observational data from several days surrounding the nominal chart date may be consulted. While imagery closest to the chart date is generally preferred, practical considerations such as data availability mean that observations from two to three days before or after the nominal date may contribute to the final analysis. As a result, the chart date should be interpreted as an approximate temporal reference rather than a precise snapshot of ice conditions at a specific time.

3.2 Historical Dates

To support consistent comparison of ice conditions across multiple years, each chart is assigned a standardized Historical Date. Historical Dates are defined as a sequence of seven-day intervals starting on January 1 of each year.

The chart date is mapped to the nearest Historical Date, allowing charts from different calendar years to be aligned. This approach accounts for the fact that the Monday of a given chart week does not fall on the same calendar date each year.

Two exceptions to the seven-day interval occur annually:

- An eight-day period between late February and early March in leap years

- An eight-day period between late November and early December to accommodate the 365-day calendar year

These adjustments ensure that Historical Dates remain seasonally consistent while covering the full year.

3.3 Analogue Charts and Chart Substitution

In some cases, charts are missing for specific Historical Dates, most commonly near the start or end of the ice season. This situation occurs when chart production began after ice formation had already started or ended before all ice had melted.

When interpolation between adjacent charts was not appropriate, analogue charts were selected from other years with similar ice formation or melt patterns. These analogue charts serve as representative substitutes and are explicitly documented in the dataset.

Appendices D through H provide a complete listing of original charts, analogue charts, and duplicated charts for each region. Unique charts are identified separately from duplicated or substituted charts for data transparency.

3.4 Evolution from Paper Charts to Digital Products

Prior to the late 1980s, regional ice charts were produced manually on paper. During this period, ice conditions were encoded using the ratio code system, and charts were distributed in hard-copy form for operational use. For climatological purposes, these historical charts were later digitized and converted into modern coding systems.

Between 1989 and 1995, chart production transitioned toward a partially digital workflow using the Ice Data Integration and Analysis System (IDIAS). While digital analysis was possible during this period, the system was primarily used for data visualization rather than full digital chart production.

In 1996, CIS adopted a fully digital workflow with the implementation of the Ice Service Integrated System (ISIS), based on commercial GIS software. From this point onward, charts were produced directly in digital form and encoded using the egg code standard. Historical ratio-code charts were retrospectively digitized to ensure continuity across the full record.

The dataset presented here integrates charts from all production eras into a consistent digital archive, while preserving information necessary to distinguish between coding systems and account for historical differences in charting practices.

4. Ice Coding Systems and Standards

4.1 Ratio Code and Egg Code: Historical Context

The information contained in Canadian Ice Service (CIS) regional ice charts has been encoded using two systems over the historical record: the ratio code and the egg code. These systems define how ice concentration, ice type, and floe size are represented on an ice chart.

From 1968–1981, ice conditions were described using the ratio code. In 1982, the ratio code was replaced by the egg code, which remains the international standard for operational ice charting. The egg code allows for additional ice types than its predecessor. The following table outlines the ratio code vs egg code eras for the different regions. Gaps between dates mark the end of an ice season and beginning of next ice season.

Region	**Ratio Code**	**Egg Code**
East Coast	January 17, 1969 to June 24, 1982 (inclusive)	December 12, 1982 to present
Hudson Bay	June 21, 1971 to March 31, 1982 (inclusive)	April 30, 1982 to present
Eastern Arctic	June 25, 1968 to March 31, 1982 (inclusive)	April 30, 1982 to present
Western Arctic	June 25, 1968 to March 31, 1982 (inclusive)	April 30, 1982 to present
Great Lakes	Era 1: December 20, 1972 to April 20, 1976 (inclusive) Era 2: December 23, 1976 to May 07, 1977 (inclusive) Era 3: December 21, 1977 to May 17, 1982 (inclusive) and December 16, 1976	December 21, 1982 to present

Although the two systems differ in structure, they describe the same underlying physical characteristics of sea ice. Historical charts originally produced using the ratio code were later digitized and converted to egg-code equivalent representations to ensure consistency within the digital archive. Therefore, older charts contain both the ratio code and its egg code equivalent, while newer charts only contain the egg code.

4.2 SIGRID-3 Standard Overview

SIGRID-3 (Sea Ice GeoReferenced Information and Data, Version 3) is an internationally recognized vector format developed to store the information contained in ice charts in a georeferenced, digital form. In this dataset, each ice chart is provided as a polygon shapefile encoded according to the SIGRID-3 specification. The use of SIGRID-3 allows the information traditionally shown on paper charts to be translated into attributes suitable for GIS-based analysis.

4.3 Canadian Ice Service Modifications to SIGRID-3

While the CIS broadly follows the 2004 SIGRID-3 specification, several modifications and clarifications have been applied to better represent Canadian ice conditions and operational practices. These modifications affect both the interpretation of certain codes and the presence or absence of specific fields.

These modifications are documented to ensure transparency and to support consistent interpretation of the data by users unfamiliar with CIS-specific practices.

- When poly_type is W, CT will have a code figure of either 00 (ice free) or 02 (bergy water) instead of the dummy variable of -9 (section 2.5 in the SIGRID documentation) (IOC, 2010)
- CIS does not use code 00 for ice free for stage of development, only the dummy variable of -9 (appendix 5, table 4.2 in the SIGRID documentation) (IOC, 2010)
- Addition of Strips and Patches 9+/10 concentration with a code figure of 20 (appendix 5, table 4.3 in the SIGRID documentation) (IOC, 2010)
- If fast ice is present anywhere, then CF is assigned 08-9

The following codes are used for lake ice.

Stage of Development	**Thickness**	**SIGRID Code**
New Lake Ice	< 5cm	81
Thin Lake Ice	5 – 15 cm	84
Medium Lake Ice	15 – 30 cm	85
Thick Lake Ice	30 – 70 cm	87
Very Thick Lake Ice	> 70 cm	91

<u>Metadata modifications</u>

- The FGDC_V2.xsl style sheet has been excluded from the XML
- The CIS Contact_Address section includes the Address and Country elements since they are required at CIS for mailing purposes
- The CIS included Contact_Electronic_Mail_Address elements to offer more contacting options to their clients, since this is the only section in the metadata where contact information is found
- The Spatial_reference_Information refers to Geographic, not Polar Stereographic

4.4 CF, FP, and FS Fields

The SIGRID-3 fields CF, FP, and FS describe the form of ice present within a polygon. In this dataset, the CF field is populated for charts produced between 1982 and 2020 and may be used to indicate fast ice, strips and patches, or predominant and secondary ice forms. The FP and FS fields were populated for the same period even though they are no longer actively used in current CIS operations. Appendix C contains a table of the CF values.

4.5 Conversion from Ratio Code to Egg Code

Special consideration is required when analyzing charts that span the transition from the ratio code to the egg code. Differences between the two systems mean that certain ice characteristics, particularly floe size, cannot be mapped exactly in all cases.

For historical charts originally produced using the ratio code, CIS applied standardized conversion rules to generate equivalent egg-code values. These rules vary by region, ice type, and concentration, and were designed to preserve the most representative physical interpretation of the original chart.

Floe Size Conversion from Ratio Code to Egg Code for Sea Ice

Possible floe sizes for sea ice coded using the ratio code and later converted to egg code are either 3, 4, 5, 6, or 8, depending on sea ice type, region, and concentration of medium floe sizes or larger.

Partial concentrations <50% in the ratio code were assigned floe size 3 in the egg code, 100% concentrations were assigned floe size 8, and new ice was always assigned "X."

The following table summarizes the egg-code values assigned for partial concentration of sea ice between 50 and 100%.

Ice Type	East Coast	Hudson Bay	Eastern Arctic/Western Arctic
MYI	4	3	6
FYI	4	5	6
Grey-white	4	5	5
Grey ice	4	4	4

Floe Size Conversion from Ratio Code to Egg Code for Lake Ice

For conversion from ratio code to the egg code for charts created between December 20, 1972 to April 20, 1976 (inclusive):

- If floes of size ≥4 were less than 50%, the floe size was coded as 3.
- If floes of size ≥4 made up a concentration of 50% or more, the floe size was coded as 4.
- If the ice was landfast, the floe size was coded as 8.
- This process was repeated for each ice type (thin, medium, and thick), so each ice type could have different floe sizes

For conversion from ratio code to the egg code for charts created between December 16, 1976 to May 17, 1982 (inclusive):

- Thick, medium, and thin ice all had the same floe size if they were all present in concentrations higher than strips and patches
- The floe size assigned to all types of ice present was the floe size group with the highest concentration, regardless of ice type. Floe size groups were 1-3, 4, and 5-7. Floe size groups were collapsed so that 1-3 became 3, 4 remained 4, and 5-7 became 5.

Up to April 20, 1976		Starting on December 16, 1976		Comment
Stage of development	**Possible floe size**	**Stage of development**	**Possible floe size**	
81	99	81	99	No change
84, 85, 87	3, 4, 8	84, 85, 87	3, 4, 5, 8	Inclusion of floe size 5

Stage of Development

The following table shows the stage of development SIGRID codes present for each region for charts that were generated during the ratio code and egg code eras. This table shows that more ice types exist in the egg code era than the ratio code.

East Coast		Great Lakes		Hudson Bay		Eastern Arctic		Western Arctic	
Ratio	**Egg**	**Ratio**	**Egg**	**Ratio**	**Egg**	**Ratio**	**Egg**	**Ratio**	**Egg**
	79		79	81	81	81	81	81	81
81	81	81	81		82		82	82	82
	82		82		83		83		83
	83			84	84	84	84	84	84
84	84	84	84	85	85	85	85	85	85
85	85	85	85	86	86	86	86	86	86
86	86			87	87	87	87	87	87
87	87	87	87	91	91	91	91	91	91
91	91		91	93	93	93	93	93	93
	93		93		95	95	95	95	95
95	95			96	96	96	96	96	96
	97				97	97	97	97	97
98	98			98	98	98	98	98	98
99	99	99	99	99	99	99	99	99	99

5. Data Quality and Known Limitations

Users conducting long-term or climatological analyses should carefully consider the following:

- The dataset spans the ratio code and egg code periods. Apparent changes in ice characteristics across the early 1980s may reflect differences in coding conventions rather than physical changes in sea ice.
- Floe size is unreliable as experts are constrained by number of polygons and eggs allowed on a chart. Floe size is considered less important than concentration and stage of development; thus, polygons may be grouped to decrease floe size variability despite being observed in the imagery.
- Floe size information derived from ratio-code charts was converted using standardized rules that vary by region and ice type. These conversions preserve overall consistency but do not always provide a one-to-one mapping.

- Analyst interpretation plays a central role in chart production, particularly in periods or regions with limited observational coverage. The charts represent expert syntheses rather than direct measurements.
- Changes in coastline representation and projection datum over time may introduce small spatial inconsistencies near coastlines.

Users are encouraged to consult the relevant appendices and metadata when designing analyses that span long time periods or combining data across regions.

5.1 Sources of Error and Uncertainty

Uncertainty in the regional sea ice charts arises from several sources inherent to the chart production process. These include limitations in the available observational data, differences in interpretation among analysts, and the constraints of representing evolving ice conditions using discrete categories and polygon boundaries.

Potential sources of error include misclassification of ice type, uncertainty in ice concentration estimates, ambiguity in floe size assignment, and spatial generalization associated with the original chart scale.

It is also important to note that the charts represent an integrated assessment over several days rather than instantaneous observations. Consequently, rapidly changing ice conditions may not be fully captured in a single weekly chart.

5.2 Coastline Variability

The SIGRID-3 shapefiles include coastline features. Early charts used coastline vectors derived from the Digital Chart of the World dataset, which was later found to contain errors in some Arctic regions, particularly in areas affected by glaciers. Beginning in the winter of 2008, CIS adopted an updated coastline based on a modified version of the World Vector Shoreline Plus dataset. These coastlines were further refined internally to correct known errors in Canadian Arctic and Greenland regions. As a result, small differences in coastline geometry may be present across the temporal record. These differences do not affect the ice polygon attributes but may be relevant for precise spatial analyses near coastlines.

5.3 Quality Assurance Procedures

Quality assurance (QA) for CIS regional ice charts involves both automated and manual processes applied during chart production and throughout the preparation of the digital archive.

Automated QA procedures include scripted checks to identify internal inconsistencies, such as invalid combinations of partial concentrations, errors in floe size coding, and spatial overlaps between adjacent regional charts. These checks help ensure that the charts conform to coding rules and internal consistency requirements.

Manual QA is performed by team leaders or other dedicated meteorologists who verifies each chart for consistency with known climatology, expected ice thickness based on accumulated freezing degree days, and coherence with adjacent regions and preceding charts. Charts are inspected prior to dissemination, archival, and publication.

A sustained effort has also been made to retrospectively review and correct archived charts. The dataset presented here incorporates all known edits and corrections identified to date.

5.4 Corrections

Several targeted correction efforts have been applied to improve the consistency and usability of the dataset, particularly for charts produced between 1990 and 2020. These include:

- Correction of known digitization errors introduced during conversion from paper charts
- Replacement of missing stage-of-development values for fast ice using climatology-based lookup tables
- Substitution of missing charts with documented analogue charts, especially in winter seasons prior to 2007
- Re-digitization of two missing Great Lakes charts
- Correction of identified egg-code errors
- Revisions to fast-ice classification where polygons were not attached to land
- Standardization of numeric concentration values where inconsistencies were identified

These corrections were applied conservatively, with the goal of improving internal consistency while preserving the original intent of the chart analyses.

5.5 Known Outstanding Issues

Despite extensive QA and correction efforts, some known issues remain in the dataset. The following items are known to be outstanding:

- N_COI contains incorrect values at times (only values of 10.3 were corrected to 10.0; error values less than 10.3 were not corrected)
- 19810101 charts are missing ratio code values for Eastern Arctic, Western Arctic, and Hudson Bay
- There are no open water charts in 1982 for East Coast and Great Lakes (although analogues from other summer seasons may be substituted)
- There are two files in the East Coast that contain an additional CF field in both the shapefile and accompanying XML (historical dates 19751218 and 19761211) whereas the rest of the data in the 1968 – 1982 period do not contain CF values

The following historical dates have zip files that do not contain the original chart in gif format.

EA	WA	HB	EC	GL
19781119	19700625	19731119	19851225	19801218
19950709	19900129	19740924	19920305	19840326
19960730	20011204	19741029	20040430	19840409
19970730	20020716	19781204	20040618	19991211
20011204	20160723	19820528	20060326	20001204
20040618	20181029	20011204	20100716	20001211
20160723		20040618	20120813	20001218
20181029		20050611	20150827	20001225

		20100716 20181029	20160723 20160813 20160827	20060409 20110521 20110528 20110604 20120604 20160521 20160528 20160611 20170528 20170604 20170611 20170618 20180611 20180618

6. Software and Data Use

The regional sea ice charts are provided as standard polygon shapefiles and can be accessed using Geographic Information System (GIS) software packages. Commonly used tools include open-source platforms such as QGIS and programming environments that support geospatial data analysis, as well as commercial GIS software.

The compressed archive files can be opened using standard zip extraction utilities. All required components for each shapefile, including projection and metadata files, are included within each archive.

7. Citation

Users of this dataset should cite the Canadian Ice Service as the data provider and reference this technical report in any publications or products derived from the data. If data are obtained from NSIDC, users should use the formal citation for the data set:

Canadian Ice Service, 2026. Canadian Ice Service Arctic Regional Sea Ice Charts in SIGRID-3 Format, Version 2. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. https://doi.org/10.7265/9nbn-6a46

Where appropriate, users are also encouraged to cite the *Manual of Standard Procedures for Observing and Reporting Ice Conditions (MANICE)* and relevant SIGRID-3 documentation.

8. References and Related Publications

Cheng, A., Casati, B., Tivy, A., Zagon, T., Lemieux, J.-F., & Tremblay, L. B. (2020). Accuracy and inter-analyst agreement of visually estimated sea ice concentrations in Canadian Ice Service ice charts using single-polarization RADARSAT-2. The Cryosphere, 14, 1289–1310. https://doi.org/10.5194/tc-14-1289-2020

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9.0 Contacts and Acknowledgements

For more information regarding this dataset at the Canadian Ice Service, please reach out to cisclients-scgclients@ec.gc.ca.

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QA/QC of the dataset was initiated by Trudy Wohlleben and completed by Angela Cheng, with assistance from Alex Gray.

10.0 Document Information

Angela Cheng produced this document with information provided by Trudy Wohlleben, Adrienne Tivy, and Brad Drummond. This document updates and adds to information from the NSIDC User Guide for this data set.

Appendix A: Sea Ice Fields and Domains

Field	Data Type	Length	Domain	Description
AREA	DOUBLE	8	area ≥ 0.0	Area of polygon in projected meters squared.
PERIMETER	DOUBLE	8	perimeter ≥ 0.0	Perimeter of polygon in projected meters.
FID	BINARY	4	integer	Internal unique polygon identifier.
REGION	CHAR	2	EA, WA, HB, GL, EC	Two-letter identifier for the region.
PNT_TYPE	CHAR	2	L, P	Polygon label type (L = label, P = point).
POLY_TYPE	CHAR	4	I, L, N, W	Classification of polygon (ice, land, no data, or open water).
Shape	N/A	—	—	ArcGIS geometry field (polygon).
CA	CHAR	2	-9, 10, 20, 30, 40, 50, 60, 70, 80, 90	Partial concentration of ice type A (tenths). / indicates trace; X unknown.
CB	CHAR	2	-9, 10, 20, 30, 40, 50, 60, 70, 80, 90	Partial concentration of ice type B (tenths).
CC	CHAR	2	-9, 10, 20, 30, 40, 50, 60, 70, 80, 90	Partial concentration of ice type C (tenths).
CD	CHAR	2	-9, 81, 84, 85, 87	Stage of development for ice thinner than SC
CN	CHAR	2	-9, 84, 85, 86, 87, 95, 96, 97	Stage of development for ice thicker than SA
CT	CHAR	2	00, 01, 02, 10, 20, 30, 40, 50, 60, 70, 80, 90, 91, 92, 98	Total ice concentration (tenths).
SA	CHAR	2	-9, 81, 84, 85, 86, 87, 91, 93, 95, 96, 97, 98, 99	Stage of development of ice reported by CA.
SB	CHAR	2	-9, 81, 84, 85, 86, 87, 91, 93, 95, 96, 97, 98, 99	Stage of development of ice reported by CB.
SC	CHAR	2	-9, 81, 84, 85, 86, 87, 91, 93, 95, 96, 97, 98, 99	Stage of development of ice reported by CC.
FA	CHAR	2	-9, 2, 3, 4, 5, 6, 7, 8, 10, 99	Predominant floe size for ice reported by SA.
FB	CHAR	2	-9, 2, 3, 4, 5, 6, 7, 8, 10, 99	Predominant floe size for ice reported by SB.
FC	CHAR	2	-9, 2, 3, 4, 5, 6, 7, 8, 10, 99	Predominant floe size for ice reported by SC.
E_CA	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8, 9	Partial concentration Ca expressed in tenths.
E_CB	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8, 9	Partial concentration Cb expressed in tenths.

E_CC	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8	Partial concentration Cc expressed in tenths.
E_CD	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7	Partial concentration Cd; rarely used, inferred if Sd is present (Cd = Ct – (Ca + Cb + Cc)).
E_CS	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8, 9, 9+	Concentration of ice in strips and patches in tenths.
E_CT	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Total ice concentration in tenths.
E_FA	CHAR	2	2, 3, 4, 5, 6, 7, 8, X	Predominant floe size of ice type reported by SA.
E_FB	CHAR	2	2, 3, 4, 5, 6, 7, 8, X	Predominant floe size of ice type reported by SB.
E_FC	CHAR	2	2, 3, 4, 5, 6, 7, 8, X	Predominant floe size of ice type reported by SC.
E_FD	CHAR	2	X	Predominant floe size of ice type reported by SD.
E_FE	CHAR	2		Placeholder for predominant floe size of ice type reported by SE (not observed in historical dataset).
E_SA	CHAR	2	1, 2, 4, 5, 6, 7, 1., 4., 7., 8., 9., X, L	Stage of development of ice reported by CA.
E_SB	CHAR	2	1, 2, 4, 5, 6, 7, 1., 4., 7., 8., 9., X, L	Stage of development of ice reported by CB.
E_SC	CHAR	2	1, 2, 4, 5, 6, 7, 1., 4., 7., 8., 9., X, L	Stage of development of ice reported by CC.
E_SD	CHAR	2	1, 4	Stage of development of ice thinner than SC.
E_SE	CHAR	2		Placeholder for stage of development of trace ice thinner than SD (not observed in historical dataset).
E_SO	CHAR	2	4, 5, 6, 7, 7., 8., 9.	Stage of development of trace ice thicker than SA.
R_CFY	CHAR	2	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of first-year ice in tenths; / indicates trace.
R_CG	CHAR	2	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of grey ice in tenths; / indicates trace.
R_CGW	CHAR	2	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of grey-white ice in tenths; / indicates trace.
R_CMY	CHAR	2	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of multi-year ice in tenths; / indicates trace.
R_CN	CHAR	2	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of new ice in tenths; / indicates trace.
R_CS	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Concentration of all ice types in strips and patches; / indicates trace.
R_CSY	CHAR	2	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of second-year ice in tenths; / indicates trace.

R_CT	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Concentration of total sea ice in tenths; / indicates trace.
R_PFY	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of first-year ice floe medium or greater; F indicates fast ice.
R_PG	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of grey ice floe medium or greater; F indicates fast ice.
R_PGW	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of grey-white ice floe medium or greater; F indicates fast ice.
R_PMY	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of multi-year ice floe medium or greater; F indicates fast ice.
R_PN	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of new ice floe medium or greater; F indicates fast ice.
R_PSY	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of second-year ice floe medium or greater; F indicates fast ice.
R_SFY	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of first-year ice with floe size 3–8; F indicates fast ice.
R_SG	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of grey ice with floe size 3–8; F indicates fast ice.
R_SGW	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of grey-white ice with floe size 3–8; F indicates fast ice.
R_SMY	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of multi-year ice with floe size 3–8; F indicates fast ice.
R_SN	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F, X	Concentration of new ice with floe size 3–8; F indicates fast ice.
R_SSY	CHAR	1	/, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, F	Concentration of second-year ice with floe size 3–8; F indicates fast ice.
N_CB	CHAR	2	0.2, 9.7	Numeric concentration code for ice type.
N_CFY	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for first-year ice.
N_CFY_M	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for first-year ice with floe size 3–8.
N_CFY_TK	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for thick first-year ice.
N_CFY_TN	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for thin first-year ice.
N_CG	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0,	Numeric concentration code for grey ice.

			7.0, 8.0, 9.0, 9.7, 10.0	
N_CGW	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for grey-white ice.
N_CMY	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for multi-year ice.
N_CN	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for new ice.
N_COI	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for old ice.
N_CSY	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for second-year ice.
N_CT	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric total ice concentration code.
N_CYI	CHAR	2	0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Numeric concentration code for young ice.

Appendix B: Lake Ice Fields and Domains

Field	Data Type	Length	Domain	Description
AREA	DOUBLE	8	area ≥ 0.0	Area of polygon in projected meters.
PERIMETER	DOUBLE	8	perimeter ≥ 0.0	Perimeter of polygon in projected meters.
FID	BINARY	4	free integer	Internal unique polygon identifier.
REGION	CHAR	2	GL	Two-letter identifier for the region represented by this chart.
PNT_TYPE	CHAR	2	106 Fast Ice 107 Open Water 115 Ice Free 117,118,120,122 Eggs (Ice) 123,128,133 No Data 400,900 Land	
POLY_TYPE	CHAR	4	I, L, N, W	Classification of polygon (ice, land, or open water).
Shape	N/A	—	—	ArcGIS geometry field (polygon).
CA	CHAR	2	-9, 10, 20, 30, 40, 50, 60, 70, 80, 90	Partial concentration of ice type A (tenths). / indicates trace; X unknown.
CB	CHAR	2	-9, 10, 20, 30, 40, 50, 60, 70, 80, 90	Partial concentration of ice type B (tenths).
CC	CHAR	2	-9, 10, 20, 30, 40, 50, 60, 70, 80, 90	Partial concentration of ice type C (tenths).
CD	CHAR	2	-9, 81	Stage of development for ice thinner than SC
CN	CHAR	2	-9, 84, 85, 87	Stage of development for trace ice thicker than SA
CT	CHAR	2	1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 91, 92, 98	Total ice concentration (tenths).
SA	CHAR	2	-9, 81, 84, 85, 87, 99	Stage of development of ice reported by CA.
SB	CHAR	2	-9, 81, 84, 85, 87, 99	Stage of development of ice reported by CB.
SC	CHAR	2	-9, 81, 84, 85, 87, 99	Stage of development of ice reported by CC.
FA	CHAR	2	-9, 3, 4, 5, 6, 8, 99	Predominant floe size for ice reported by SA.
FB	CHAR	2	-9, 3, 4, 5, 6, 8, 99	Predominant floe size for ice reported by SB.
FC	CHAR	2	-9, 3, 4, 5, 6, 8, 99	Predominant floe size for ice reported by SC.
E_CA	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8, 9	Partial concentration Ca expressed in tenths.

E_CB	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8, 9	Partial concentration Cb expressed in tenths.
E_CC	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8	Partial concentration Cc expressed in tenths.
E_CD	CHAR	2	1, 2, 3, 4, 5, 6, 7	Partial concentration Cd; rarely used, inferred if Sd is present (Cd = Ct – (Ca + Cb + Cc)).
E_CS	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8, 9, 9+	Concentration of ice in strips and patches in tenths.
E_CT	CHAR	2	1, 2, 3, 4, 5, 6, 7, 8, 9, 9+	Total ice concentration in tenths.
E_FA	CHAR	2	unknown, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, X	Predominant floe size of ice type reported by SA.
E_FB	CHAR	2	unknown, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, X	Predominant floe size of ice type reported by SB.
E_FC	CHAR	2	unknown, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, X	Predominant floe size of ice type reported by SC.
E_FD	CHAR	2	unknown, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, X	Predominant floe size of ice type reported by SD.
E_FE	CHAR	2	unknown, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, X	Predominant floe size of ice type reported by SE.
E_SA	CHAR	2	unknown, 1, 2, 3, 4, 5, 6, 7, 8, 9, 1., 4., 5., 7., 8., 9., X, L	Stage of development of ice reported by CA.
E_SB	CHAR	2	unknown, 1, 2, 3, 4, 5, 6, 7, 8, 9, 1., 4., 8.	Stage of development of ice reported by CB.
E_SC	CHAR	2	unknown, 1, 2, 3, 4, 5, 6, 7, 8, 9, 1., 4., 8.	Stage of development of ice reported by CC.
E_SD	CHAR	2	unknown, 1, 2, 3, 4, 5, 6, 7, 8, 9, 4	Stage of development of ice thinner than SC.
E_SE	CHAR	2	unknown, 1	Stage of development of trace ice thinner than SD.
E_SO	CHAR	2	4, 5, 6, 7, 7., 8., 9.	Stage of development of trace ice thicker than SA.
R_CM	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Concentration of medium lake ice in tenths; / indicates trace.
R_CN	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Concentration of new lake ice in tenths; / indicates trace.
R_CS	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Concentration of small lake ice in tenths; / indicates trace.
R_CT	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Concentration of total lake ice in tenths; / indicates trace.
R_CTK	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Concentration of thick or very thick lake ice in tenths; / indicates trace.

R_CTN	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Concentration of thin lake ice in tenths; / indicates trace.
R_N1	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Left-most floe size value; varies by encoding era.
R_N2	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Middle floe size value; varies by encoding era.
R_N3	CHAR	2	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9+, 10	Right-most floe size value; varies by encoding era.
N_CT	CHAR	4	unknown, 0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Concentration of ice. Undefined is “”, ice free is 0.0, open water is 0.3, and 9+ is 9.7.
N_CVTK	CHAR	4	unknown, 0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Concentration of very thick lake ice. (in the case of (R_CT "9+" or E_CT "9+") and N_CTK = "10.0", N_CTK was adjusted to "9.7")
N_CTK	CHAR	4	unknown, 0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Concentration of thick lake ice. (in the case of (R_CT "9+" or E_CT "9+") and N_CTK = "10.0", N_CTK was adjusted to "9.7")
N_CM	CHAR	4	unknown, 0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Concentration of medium lake ice. in the case of (R_CT "9+" or E_CT "9+") and N_CM = "10.0", N_CM was adjusted to "9.7"
N_CTN	CHAR	4	unknown, 0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Concentration of thin lake ice. in the case of (R_CT "9+" or E_CT "9+") and N_CTN = "10.0", N_CTN was adjusted to "9.7"
N_CN	CHAR	4	unknown, 0.0, 0.3, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 9.7, 10.0	Concentration of new lake ice. in the case of (R_CT "9+" or E_CT "9+") and N_CN = "10.0", N_CN was adjusted to "9.7"

Appendix C: Codes for SIGRID-3 CF

The CF field as defined by the JCOMM SIGRID-3 Specification of 2004 requires some interpretation since it is a compound field (CF predominant-CF secondary) representing predominant and secondary forms of ice yet the field can also be used to indicate Strips and Patches or Fast ice.

It is expected that this field will require further refinement in terms of content and usage.

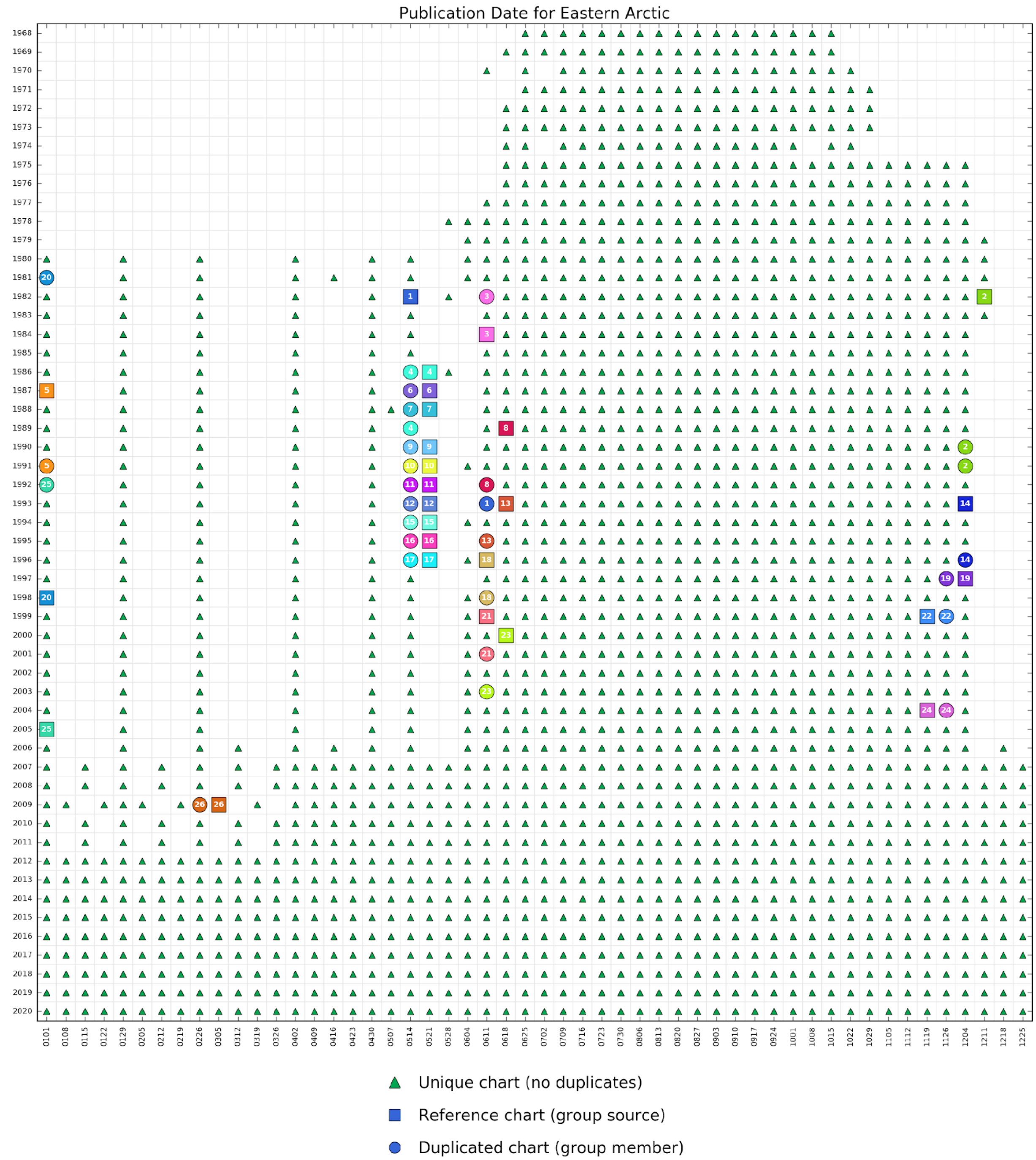
Current usage is to use one of the following three, mutually exclusive scenarios;

1. If fast ice is present anywhere then CF is assigned 08-9
2. Else if strips and patches are present, then CF predominant contains the strips and patches details and CF secondary is assigned -9 (e.g. 19-9)
3. Otherwise, CF predominant contains the predominant form of ice and CF secondary contains the secondary form of ice. If there is no secondary form, then CF secondary is assigned -9

CF Code	Usage	CF Predominant	CF Secondary
08-9	Fastened (Fast) Floe	08	-9
11-9	Strips and Patches (1/10)	11	-9
12-9	Strips and Patches (2/10)	12	-9
13-9	Strips and Patches (3/10)	13	-9
14-9	Strips and Patches (4/10)	14	-9
15-9	Strips and Patches (5/10)	15	-9
16-9	Strips and Patches (6/10)	16	-9
17-9	Strips and Patches (7/10)	17	-9
18-9	Strips and Patches (8/10)	18	-9
19-9	Strips and Patches (9/10)	19	-9
20-9	Strips and Patches (9+/10)	20	-9
20-9	Strips and Patches (10/10)	20	-9
00-9	Pancake Ice	00	-9
01-9	Shuga/Small Ice cake, Brash Ice	01	-9
02-9	Ice Cake	02	-9
03-9	Small Floe	03	-9
04-9	Medium Floe	04	-9
05-9	Big Floe	05	-9
06-9	Vast Floe	06	-9
07-9	Giant Floe	07	-9
09-9	Growlers, Floebergs, Floebits	09	-9
10-9	Icebergs	10	-9
99-9	Unknown/Undetermined	99	-9
XX01	Shuga/Small Ice Cake, Brash Ice	XX from Floe Size Codes for SIGRID-3	01
XX02	Ice Cake	XX from Floe Size Codes for SIGRID-3	02
XX03	Small Floe	XX from Floe Size Codes for SIGRID-3	03
XX04	Medium Floe	XX from Floe Size Codes for SIGRID-3	04

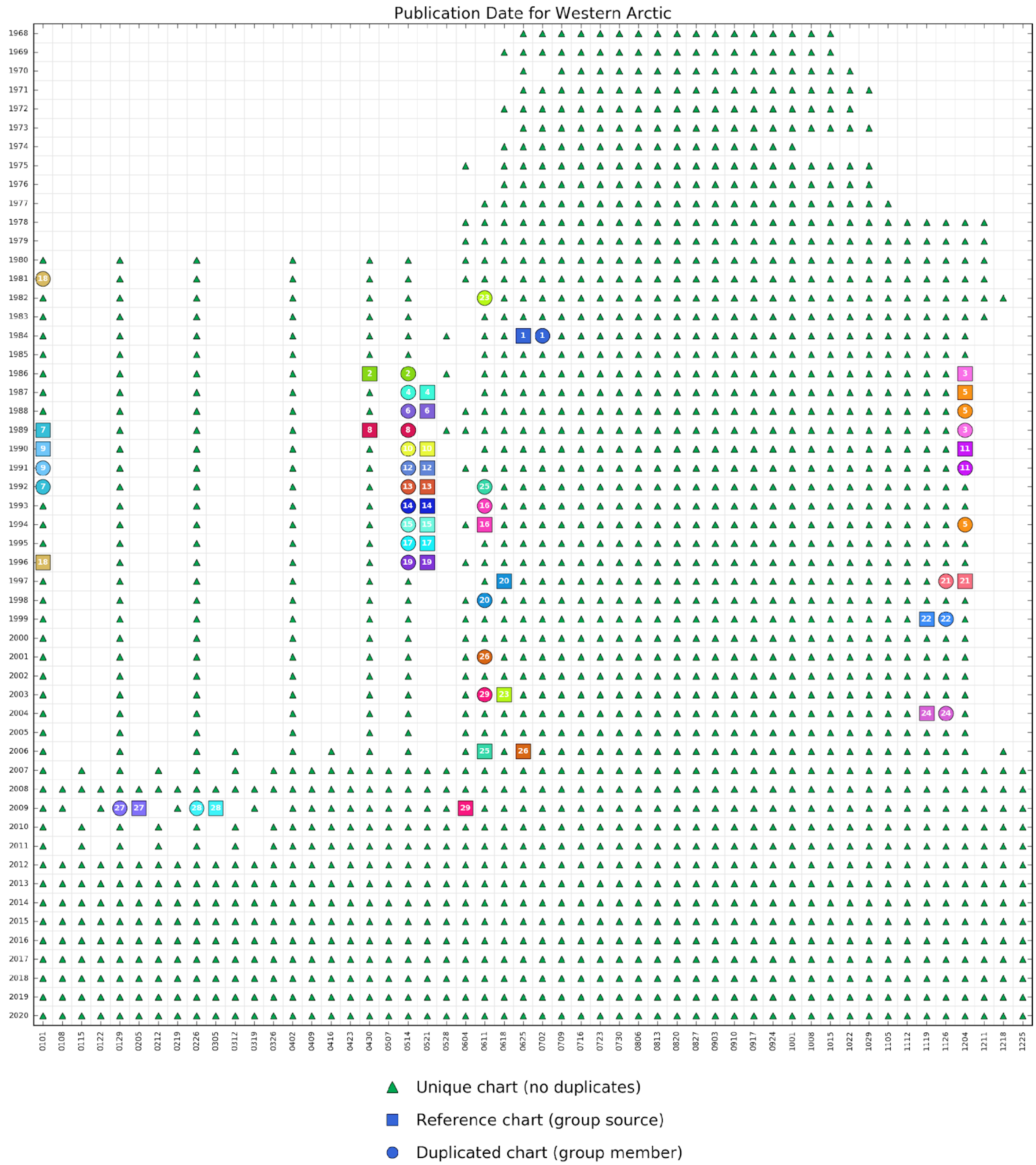
XX05	Big Floe	XX from Floe Size Codes for SIGRID-3	05
XX06	Vast Floe	XX from Floe Size Codes for SIGRID-3	06
XX07	Giant Floe	XX from Floe Size Codes for SIGRID-3	07
XX09	Growlers, Floebergs, Floebits	XX from Floe Size Codes for SIGRID-3	09
XX10	Icebergs	XX from Floe Size Codes for SIGRID-3	10
XX99	Unknown/Undetermined	XX from Floe Size Codes for SIGRID-3	99
-9-9	Null Value	-9	-9

Appendix D: Eastern Arctic Charts



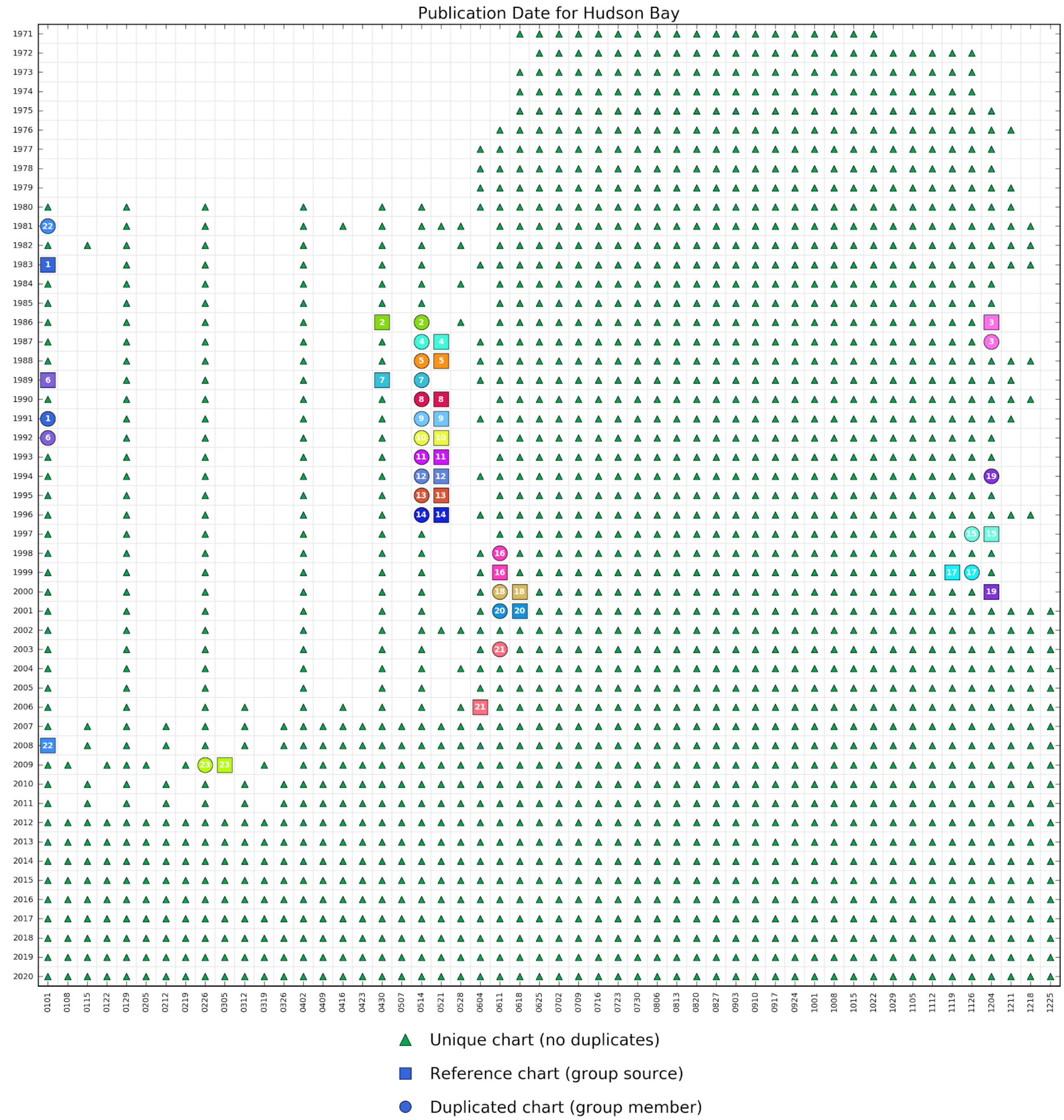
Charts sharing the same number and colour are identical. The reference chart is the representative chart used for the group.

Appendix E: Western Arctic Charts



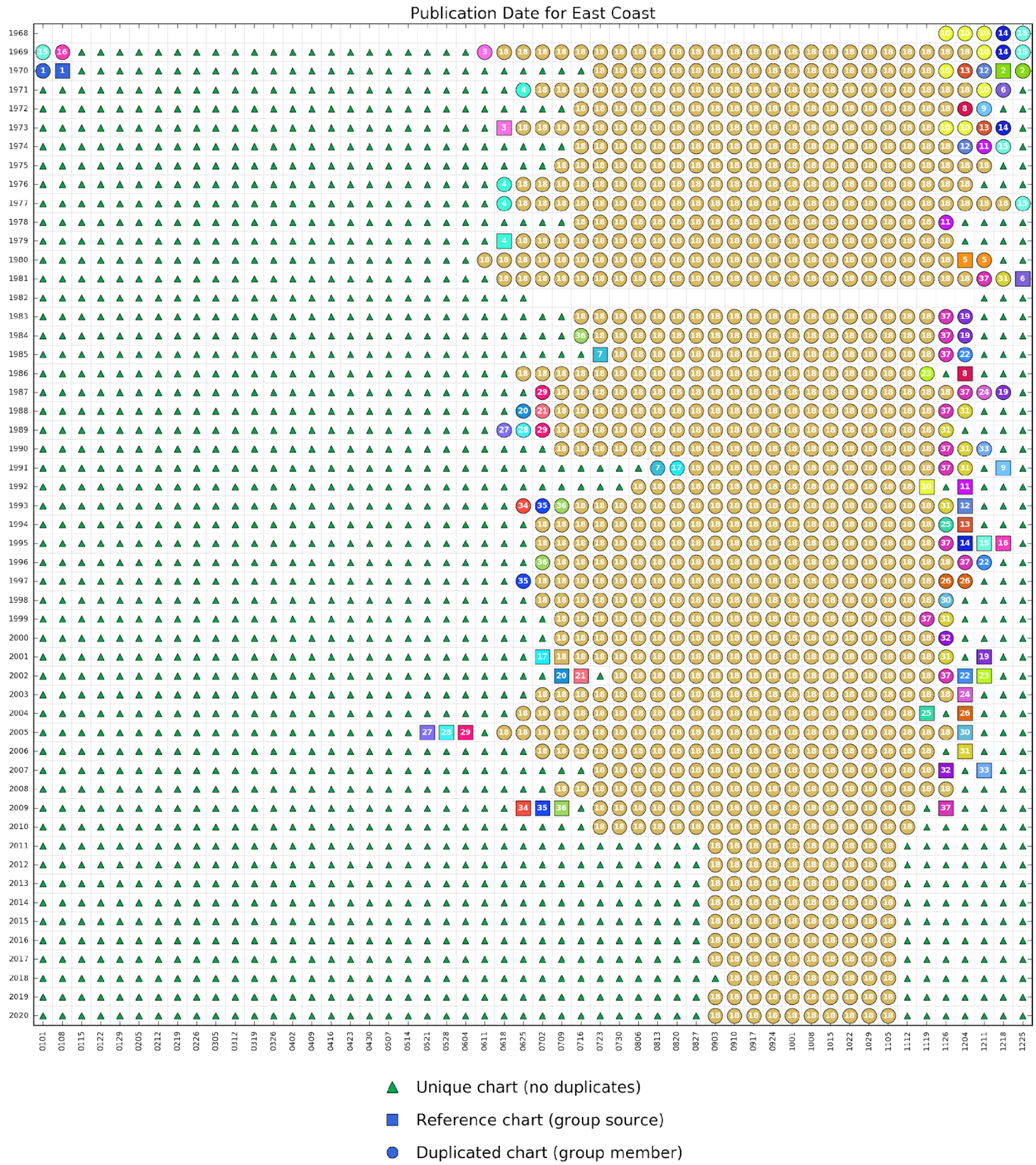
Charts sharing the same number and colour are identical. The reference chart is the representative chart used for the group.

Appendix F: Hudson Bay Charts



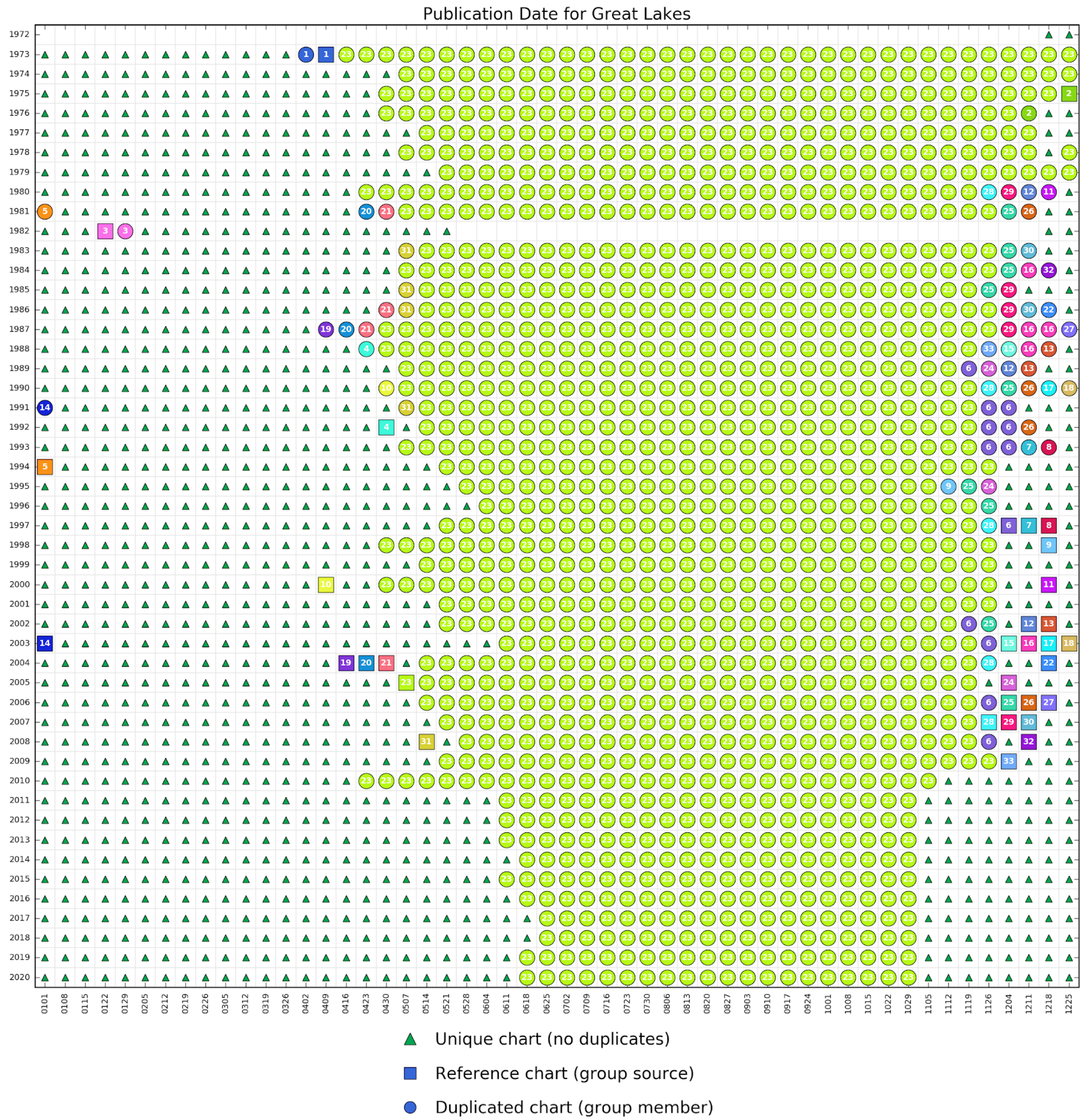
Charts sharing the same number and colour are identical. The reference chart is the representative chart used for the group.

Appendix G: East Coast Charts



Charts sharing the same number and colour are identical. The reference chart is the representative chart used for the group.

Appendix H: Great Lakes Charts



Charts sharing the same number and colour are identical. The reference chart is the representative chart used for the group.