

Geological Survey of Canada

**THE TERRITORIAL SEA BASELINES
AND FISHING ZONE LIMITS
OF CANADA, IN DIGITAL FORM**

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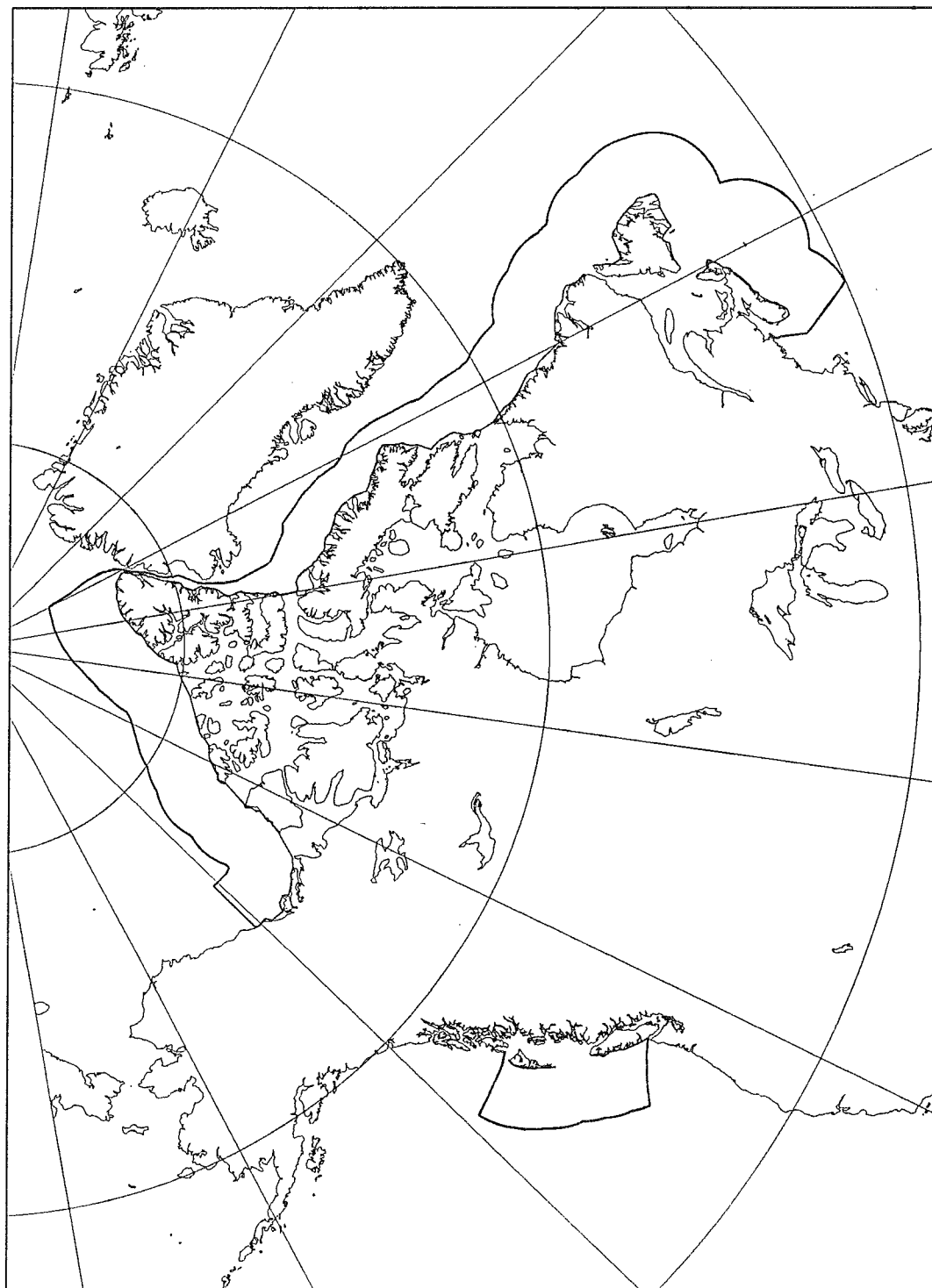
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Frontispiece: Canadian Territorial Sea Baselines and Fishing Zone Limits



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Introduction

This report describes the creation and organization of two computer readable data sets that define most of Canada's territorial sea baselines and fishing zone limits. The data sets consist of series of geographical coordinates that were obtained in three ways:

- a) by extraction from official publications;
- b) by digitizing from official charts;
- c) by geodetic calculation according to officially-defined rules.

The data sets are stored as DOS ASCII files for distribution on standard 5¼-inch diskettes.

The primary intention of this project was to provide convenient data sets for those who routinely produce maps by computer at scales of 1:250,000 and above (i.e. showing a bigger geographical region per unit of map area), and who want to portray baselines and limits in a general fashion.

It should be noted that the legal descriptions of baselines, territorial sea limits, and fishing zone limits are contained in various Orders-in-Council issued pursuant to the Territorial Seas and Fishing Zones Act. Graphical depictions of some baselines and outer limits are to be found on certain charts issued by the Canadian Hydrographic Service. Where portions of the territorial sea baselines were digitized from official charts for the purposes of this project, it should be appreciated that the results of chart digitization are dependent to a large extent on methodology and operator interpretation. Computer plots derived from the digitized results may therefore differ in some respects from depictions shown on official charts.

Users are advised to treat the data sets with a measure of caution, and to refrain from imputing any legal authority to the products so derived. In all situations involving legal interpretation, the official statutes and charts have the final authority.

Territorial sea baselines

The baseline is the line from which the outer limits of the territorial sea, the contiguous zone, the exclusive economic zone (EEZ), etc. are measured to the appropriate breadth (Kapoor and Kerr, 1986).

Canada's baselines are legally described in two Orders within the Territorial Sea and Fishing Zones Act:

- a) the Territorial Sea Geographical Coordinates Order (Canada, 1978b);
- b) the Territorial Sea Geographical Coordinates (Area 7) Order (Canada, 1985b).

The Orders contain three Schedules that define separate sets of baseline segments according to different criteria:

- a) as straight lines joining listed points (Schedule I);
- b) as low-water lines along the coast joining listed points (Schedule II);
- c) as low-water lines of named islands and low-tide elevations (Schedule III);

The baselines described in Schedule III are associated for the most part with small features e.g. islets and shoal areas that appear at low tide. These have not been included in the data base. A fourth Schedule defines the dividing line between Newfoundland and the Islands of St. Pierre and Miquelon; this information is not part of the data base either.

The Orders are further divided into seven Areas that encompass the following geographic regions:

- 1. Labrador
- 2. Southeast and East Newfoundland
- 3. Southwest Newfoundland
- 4. Nova Scotia
- 5. Vancouver Island
- 6. Queen Charlotte Islands
- 7. Canadian Arctic Islands and Mainland

For the purposes of this project, baselines are defined as straight lines only in Areas 1, 3, 4, 5, and 6 (i.e. they appear in Schedule I only). In Areas 2 and 7, baselines are defined as a mix of straight lines and low-water lines (i.e. they appear in Schedules I and II).

Creation of the Territorial Sea Baselines data set

The initial data set was created by staff of Evans Computer Applications Limited, Halifax.

Geographic coordinates of the endpoints of straight baseline segments for each Area were read from Schedule I and keyed into separate computer files. The input process included conversion from the degrees-minutes-seconds format of the Orders to degrees and decimal fractions.

A digitizing table was used to trace low-water baseline segments from the CHS charts listed in Appendix A, and to transfer their geographical coordinates into separate computer files. During this process, there were minor difficulties in matching some features between official charts and the Order. Also, some extemporizing was necessary where the low-water line crossed certain chart limits. These cases are described briefly in the Contractor's notes contained in Appendix B.

Contents of the straight-line and low-water files were verified by plotting them at appropriate scales and projections for comparison with official charts. Errors were generally due to mistakes in data entry or in digitizing charts; these were corrected.

After verification, files were joined in sequence to produce a continuous baseline definition starting at a point in southwest Nova Scotia, proceeding counterclockwise around the Canadian land mass, and ending at a point in southwest Vancouver Island. These are shown in Figures 1, 2 and 3 for the Atlantic, Arctic, and Pacific coasts, respectively.

Fishing zone limits

These limits circumscribe the areas where Canada claims jurisdiction over the living resources of the sea.

Canada's fishing zone limits are described in three Orders within the Territorial Sea and Fishing Zones Act:

- a) the Fishing Zones of Canada (Zones 1, 2 and 3) Order (Canada, 1978a);
- b) the Fishing Zones of Canada (Zones 4 and 5) Order (Canada, 1979, amended 1985a);
- c) the Fishing Zones of Canada (Zone 6) Order (Canada, 1978a).

The Orders contain several schedules that define separate sets of limits in four different ways:

- a) as straight lines joining listed points (in relatively constricted waters);
- b) as geodesic lines joining listed points (for bilateral international limits and other locations);
- c) as arcs of 200-nautical mile circles centred on listed points;
- d) as a line which is everywhere 200 nautical miles distant from the nearest point of the territorial sea baseline.

The Orders are further divided into six geographic Zones, with some Zones further subdivided into numbered Areas:

1. Gulf of St. Lawrence
2. Bay of Fundy
3. Queen Charlotte Sound, Hecate Strait and Dixon Entrance
4. Davis Strait (Area 1) to Gulf of Maine Region (Area 2)
5. Juan de Fuca Region (Area 1) to Dixon Entrance Region (Area 2)
6. Beaufort Sea (Area 1) to Nares Strait, Lincoln Sea Region (Area 3) and Baffin Bay, Nares Strait Region (Area 2).

As the intention of the project was to focus on international limits, Zones 1, 2 and 3 were not included in the data set because they are located landward of other Canadian fishing zones. The limits of Zones 4 and 5 are defined by combinations of geodesic lines and 200 nautical mile circular arcs. The limit of Zone 6 is defined by a combination of geodesic lines and a 200 nautical mile equidistant line.

Creation of the Fishing Zone Limits data set

Geographic coordinates for the endpoints of geodesic lines were read from the appropriate schedules for each numbered Area in Zones 4, 5 and 6, and keyed into separate computer files. The input process included conversion from the degrees-minutes-seconds format of the Orders to degrees and decimal fractions. These procedures were carried out by staff of Evans Computer Applications Limited, Halifax.

Coordinates for the 200 nautical mile circular arcs and equidistant line were calculated with DELMAR, a geodetic package developed for the delimitation of maritime boundaries (Carrera, 1988). To derive the circular arcs of Zones 4 and 5 (Atlantic and Pacific coasts), DELMAR required input data that consisted of the geographic coordinates of the arc centres, as listed in the Orders. To derive the equidistant line of Zone 6 (Arctic coast), DELMAR required the geographic coordinates of the territorial sea baselines of Area 7 (Canadian Arctic Islands and Mainland), described earlier. In either case, the program calculated the geographic coordinates of closely-spaced points that defined a series of intersecting arcs with a 200 nautical mile radius, and stored these values in a computer file.

Contents of the geodesic, arc, and equidistant line files were verified in Zones 4 and 5 (Atlantic and Pacific coast) by plotting them at appropriate scales and projections for visual comparison with official charts. Errors in the geodesics were easily noted and corrected; these were usually caused by mistakes in data entry. Similar comparisons were not possible in Zone 6 (Arctic coast), because official charts showing fishing limits had not yet been issued.

After verification, files were joined in sequence to produce a continuous definition of the fishing zone limits starting at a point in southern New Brunswick, proceeding counterclockwise around the Canadian land mass, and ending at a point in the Strait of Juan de Fuca. These are shown in Figures 1, 2 and 3 for the Atlantic, Arctic, and Pacific coasts, respectively.

Format and organization of the data files

The territorial sea baselines and the fishing zone limits are contained in two ASCII files: BASELINES.CANADA and FISHZONE.CANADA. Explanatory notes begin each file (reproduced in Appendix C), and more detailed notes are interspersed throughout the data sets.

Acknowledgements

We are indebted to Jacob Verhoef and Karl Usow for advice on the organization of the data, and for modifications to the software for producing working plots as well as final figures. Pam Langille of Evans Computer Applications Ltd. performed most of the baseline digitizing. P.K. Mukherjee and David Gray of the Canadian Hydrographic Service critiqued the first draft of this report and offered valuable comments concerning the delineation of offshore limits.

References

- Canada. 1978a. Territorial Sea and Fishing Zones Act: Fishing Zones of Canada (Zones 1,2 and 3) Order; Fishing Zones of Canada (Zones 4 and 5) Order; Fishing Zones of Canada (Zone 6) Order. Consolidated Regulations v. XVIII, p. 1547-1549.
- Canada. 1978b. Territorial Sea and Fishing Zones Act: Territorial Sea Geographical Coordinates Order. Consolidated Regulations v. XVIII, p. 1550.
- Canada. 1979. Fishing Zones of Canada (Zones 4 and 5) Order. Canada Gazette Part II, SOR/79-107, p. 482.
- Canada. 1985a. Fishing Zones of Canada (Zones 4 and 5) Order, amendment. Canada Gazette Part II, SOR/85-229, p. 1529.
- Canada. 1985b. Territorial Sea Geographical Coordinates (Area 7) Order. Canada Gazette Part II, SOR/85-872, p. 3996.
- Carrera, G. 1988. DELMAR computer program library. International Centre for Ocean Development, Halifax, NS.
- Kapoor, D.C., and A.J. Kerr. 1986. A guide to maritime boundary delimitation. 123 p. Carswell, Toronto, ON.

Figure 1: Atlantic Territorial Sea Baselines and Fishing Zone Limits

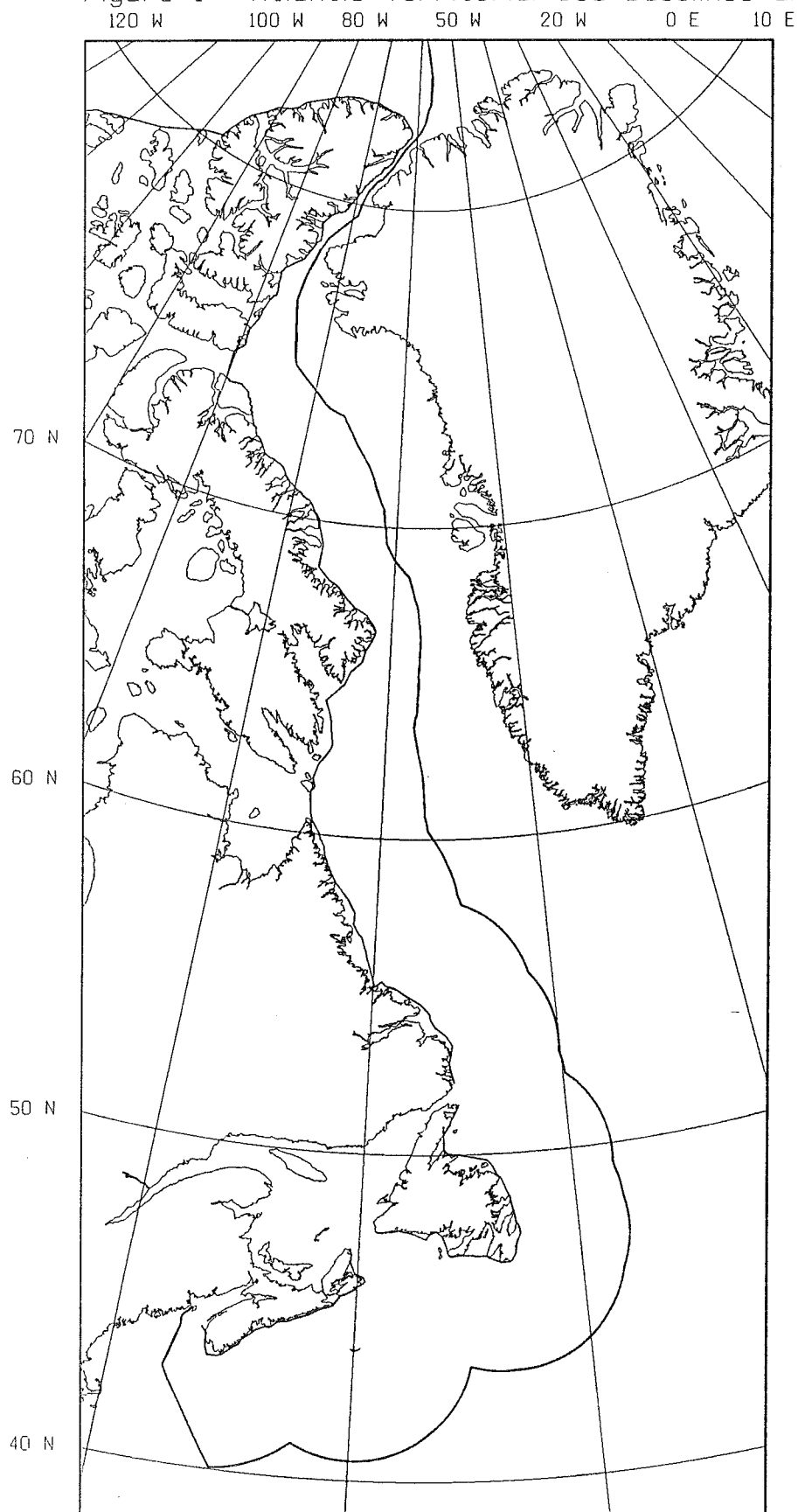


Figure 2: Arctic Territorial Sea Baselines and Fishing Zone Limits

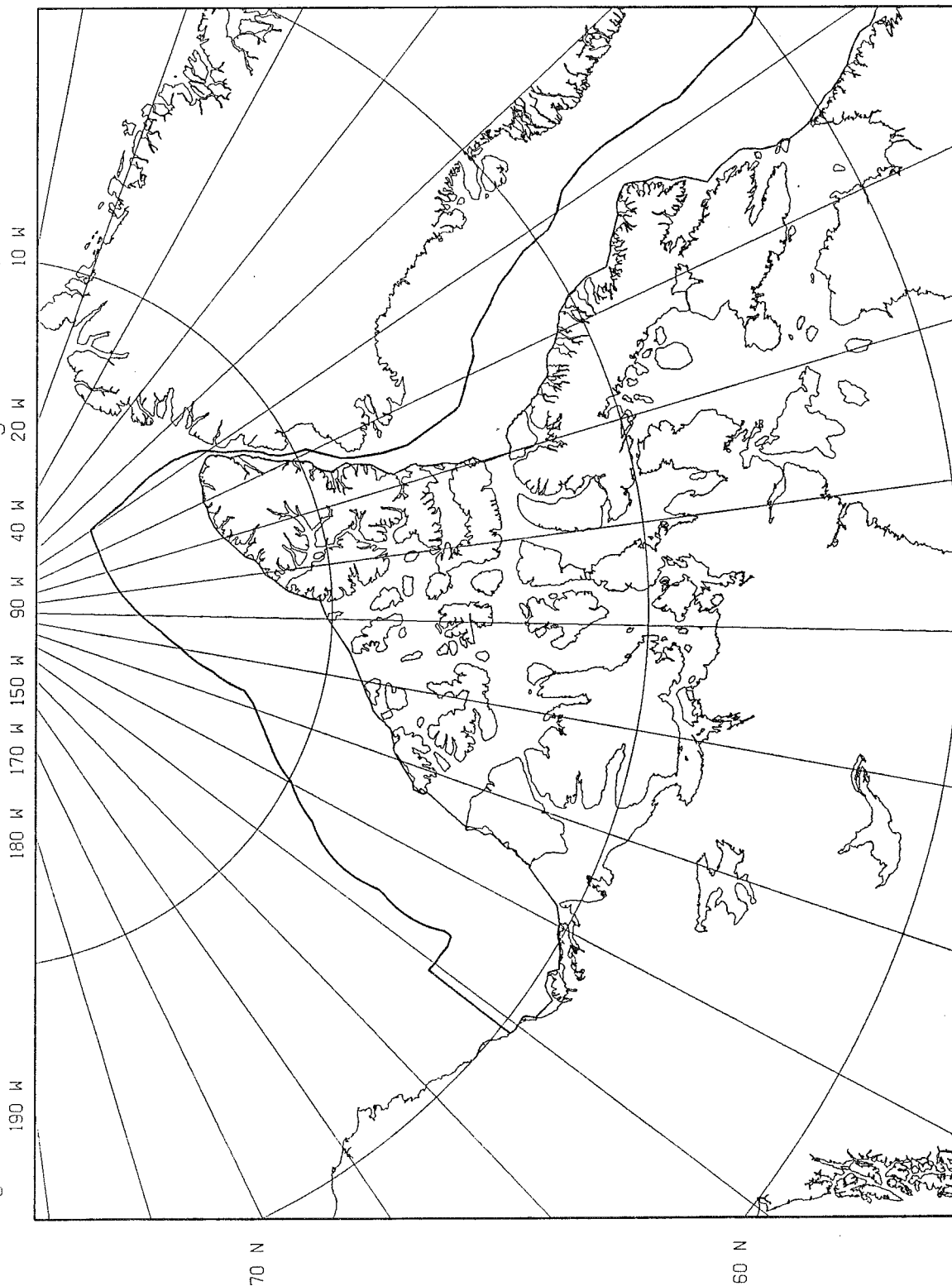


Figure 3: Pacific Territorial Sea Baselines and Fishing Zone Limits



APPENDIX A

Official Canadian Hydrographic Service charts used to digitize the low-water line delineating the territorial seas baselines in Areas 2 (Southeast and East Newfoundland) and 7 (Canadian Arctic islands and Mainland).

| Chart number (in order of use) | Year |
|-----------------------------------|------|
| Area 2: | |
| 4016 | 1987 |
| Area 7: | |
| 7601 | 1979 |
| 7602 | 1981 |
| 7604 | 1984 |
| 7605 | 1984 |
| 7606 | 1984 |
| 7081 | 1971 |
| 7832 | 1971 |
| 7952 | 1972 |
| 7953 | 1972 |
| 7954 | 1974 |
| 7304 | 1978 |
| 7072 | 1971 |
| 7071 | 1964 |
| 7302 | 1978 |
| 7220 | 1979 |
| 7217 | 1983 |
| 7053 | 1983 |
| 7052 | 1966 |
| 7051 | 1973 |
| 7050 | 1961 |
| 4773 | 1963 |

APPENDIX B

Contractor's notes recorded while digitizing low-water line off CHS charts in baseline Area 7 (Canadian Arctic Islands and Mainland).

1. Schedule I of the Territorial Sea Geographical Coordinates (Area 7) Order lists Cape Kellett at 71°59'10" N, 126°01'00" W on Chart 7081(1979), and Meek Point on Chart 7832(1971). To digitize between these features, we used Chart 7832, having first used Chart 7081 to identify the point on Cape Kellett where digitizing should begin. Cape Kellett's location differs slightly between the two charts.
2. The digitized line between Cape Fanshawe Martin and Cape Richards on Chart 7954(1974) is an ice line, and not a low-water line.
3. The coordinates given for St. Patrick's Bay on Schedule I of the Territorial Sea Geographical Coordinates (Area 7) Order indicate a location slightly inland from the coastline shown on Chart 7304(1978).
4. The line between Cape Bowen and Cape Cloutts was digitized from Chart 7217(1983), and not 7220(1979), as listed in Schedule I of the Territorial Sea Geographical Coordinates (Area 7) Order. However its position was identical on both charts.
5. Schedule I of the Territorial Sea Geographical Coordinates (Area 7) Order lists Cape Eglinton at 70°47'12" N, 69°14'30" W on Chart 7217(1983) and Cape Christian on Chart 7053(1970). To digitize between these two points, we used Chart 7053, having first used Chart 7217 to identify the point on Cape Eglinton where digitizing should begin. Cape Eglinton's location differs slightly between the two charts.

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APPENDIX C

Notes extracted from files BASELINES.CANADA and FISHZONE.CANADA.

BASELINES.CANADA is an ASCII file which represents the Canadian territorial sea baselines as defined in the Territorial Sea Geographical Coordinates Order. In addition to the discontinuity between the Beaufort and the Pacific baselines, the Order contains gaps between certain points where the baseline is broken by wide straits and inlets. The discontinuous line segments are separated in the file by END LINE and BEGIN LINE comments following pairs of 9999's.

For details on the sources of data and on the creation of this file, refer to GSC Open File Report Number 2000: The Territorial Sea Baselines and Fishing Zone Limits of Canada, in Digital Form (Hull, Carrera, and Macnab). The Report also contains statements to the effect that this file was developed strictly for use as an aid to map production by computer, and not as a legal reference.

The first two columns are the latitude and longitude of baseline points in decimal form. The third column is the number of the CHS chart where the baseline appears. For the Arctic, the fourth column is the year of the chart edition, the fifth the basepoint number and the sixth its name. Outside of the Arctic, the column for the chart edition is absent.

The file is punctuated by comments either on the same line as data and following it, or following pairs of 9999's which also appear alone to make the file more readable. Obviously, 9999's should be ignored as data.

For example:

| 9999 | 9999 | | CHART | YEAR | PT.# | LOCATION |
|------------|----------|------|-------|---------|--------------|----------|
| | | | | OF | | |
| | | | | EDITION | | |
| 9999 | 9999 | | | | | |
| BEGIN LINE | | | | | | |
| 60.4388 | -64.4297 | 4773 | 63 | 163 | CABOT ISLAND | |
| | X | | | | | |
| 60.5750 | -64.5250 | 4773 | 63 | 162 | KNIGHT GROUP | |
| 60.6850 | -64.5833 | 4773 | 63 | 161 | LACY ISLAND | |

FISHZONE.CANADA is an ASCII file which represents the Canadian fishing zone limits. It is a composite of the 200 nm limit and a series of bilateral limits defined in the Fishing Zones of Canada Order, with a discontinuity between the Beaufort Sea and the Pacific Ocean. That break has been identified in the file by END LINE and BEGIN LINE comments following pairs of 9999's. At a few places, editing involved the creation or deletion of a point. Duplications have also been removed. This was all noted in the file. Clearly, this work is not intended to be used for legal purposes.

For details on the sources of data and on the creation of this file, refer to GSC Open File Report Number 2000: The Territorial Sea Baselines and Fishing Zone Limits of Canada, in Digital Form (Hull, Carrera, and Macnab). The Report also contains statements to the effect that this file was developed strictly for use as an aid to map production by computer, and not as a legal reference.

The first two columns are the latitude and longitude of points on the line in decimal form. The third column, an integer, is, for the computed 200 nm. limit, an arbitrary counter. For the bilateral boundaries, it is the published number of that point.

The file is punctuated by comments either on the same line as data and following it, or following pairs of 9999's which also appear alone to make the file more readable. Obviously, 9999's should be ignored as data.

For example:

```
9999 9999 Outer Limits of Fishing Zone 4 - Atlantic
9999 9999
9999 9999 Specified in Fishing Zones of Canada Order

9999 9999 Zones 4 and 5)

9999 9999
9999 9999 Schedule 1, Area 2: Gulf of Maine Region

9999 9999
    44.7763    -66.9030    1
    44.7621    -66.9177    2
    44.7558    -66.9263    3
```