

# GEOCOD

GEOMATICS FOR THE SUSTAINABLE MANAGEMENT OF FISH STOCKS

LA GEOMATIQUE AU SERVICE DE LA GESTION DURABLE DES STOCKS DE POISSONS

## GeoCod - Integrated database of fisheries data

Rodolphe Devillers

Geography, Memorial University of Newfoundland



# Outline

- Objective
- Integrated Database
- Environmental Data
- Fisheries Data
- Metadata
- Conclusions



# GeoCod – Objective 1

- “To integrate heterogeneous fisheries and environmental data into a single data model that will be suitable for subsequent analyses and visualisation”



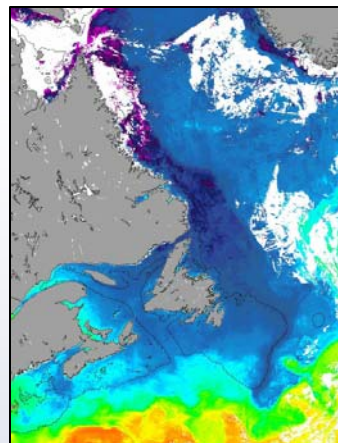
Region of interest: North-West Atlantic region

# Building an integrated database

- To better support the management, analyses and communication related to marine ecosystems we identified and collected a wide range of existing data on fish and physical environment for the North-West Atlantic region.



Fisheries data



Remote sensing



Oceanographic data

# Outline

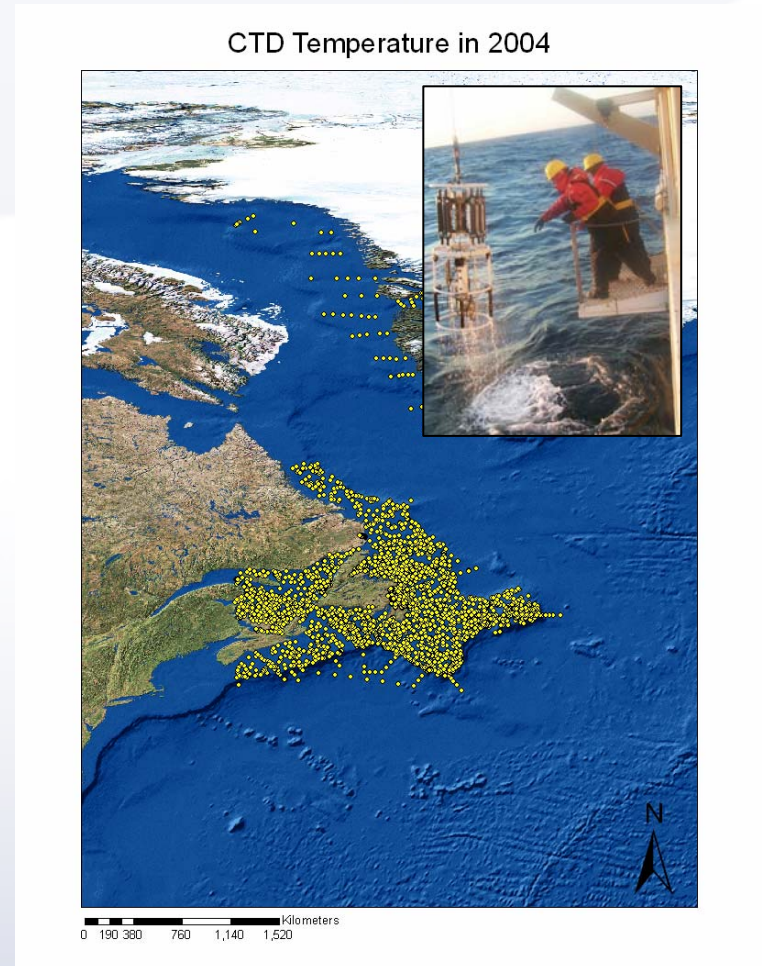
- Objective
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# Environmental data

- Various sources of data:
  - MEDS (Marine Environment Data System) = DFO Archives
  - NODC (National Oceanographic Data Centre)
  - Remote sensing

= more than 300 Gb of data!!!



# Environmental data

Data		Years								
		1970	1975	1980	1985	1990	1995	2000	2005	
<b>Bathythermographic data (BT)</b>	XYBT_DATA_TEMP		1975-2005							
	XYBOTTLE_TEMP		1975-2005							
<b>Conductivity-Temperature-Depth data (CTD)</b>	XYCTD_DATA_TEMP		1975-2005							
	<b>Practical salinity (PSAL)</b>	XYCTD_DATA_PSAL		1975-2005						
<b>Salinity (pre-1978 definition) (SSAL)</b>	XYCTD_DATA_SSAL		1977-79-81-88-93							
	XYCTD_DATA_MNS					1992-1993				
	XYCTD_DATA_MXS					1992-1993				
	XYCTD_DATA_SDS					1992-1993				
	XYBOTTLE_PSAL		1975-2005							
<b>Salinity (pre-1978 definition) (SSAL)</b>	XYBOTTLE_SSAL		1975-1994							
<b>Undefined salinity (USAL)</b>	XYBOTTLE_USAL		1975-1994							
	XYBOTTLE_PRP		1980-81							
<b>Chlorophyll A content (CPHL)</b>	XYBOTTLE_CPHL		1975-2005							
	XYBOTTLE_CPH						1995-2005			
	XYARGO_PSAL						2001-2005			
	XYARGO_TEMP						2001-2005			



## CTD Temperature in 1975



**Environmental  
(MEDS)**

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## CTD Temperature in 1980

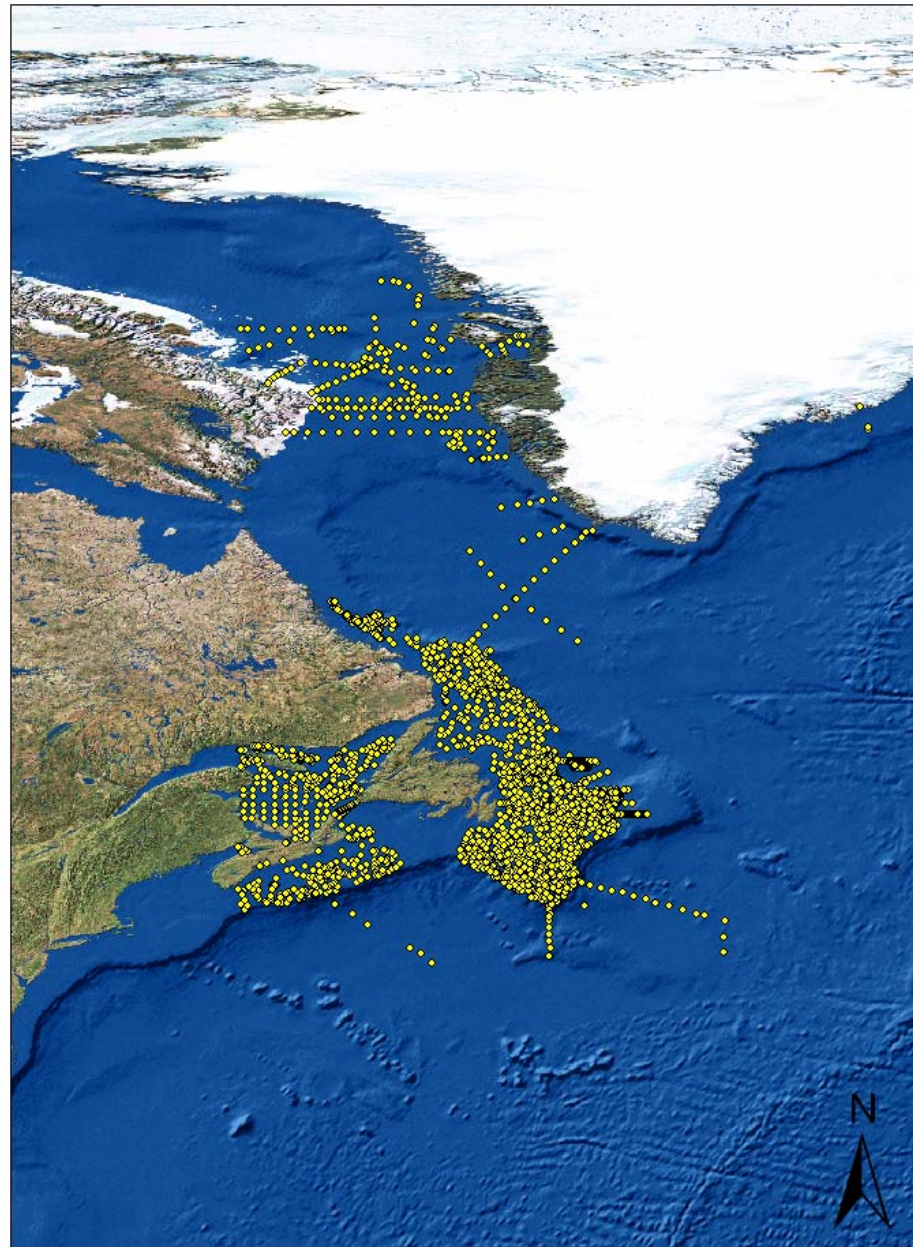


**Environmental  
(MEDS)**

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## CTD Temperature in 1990



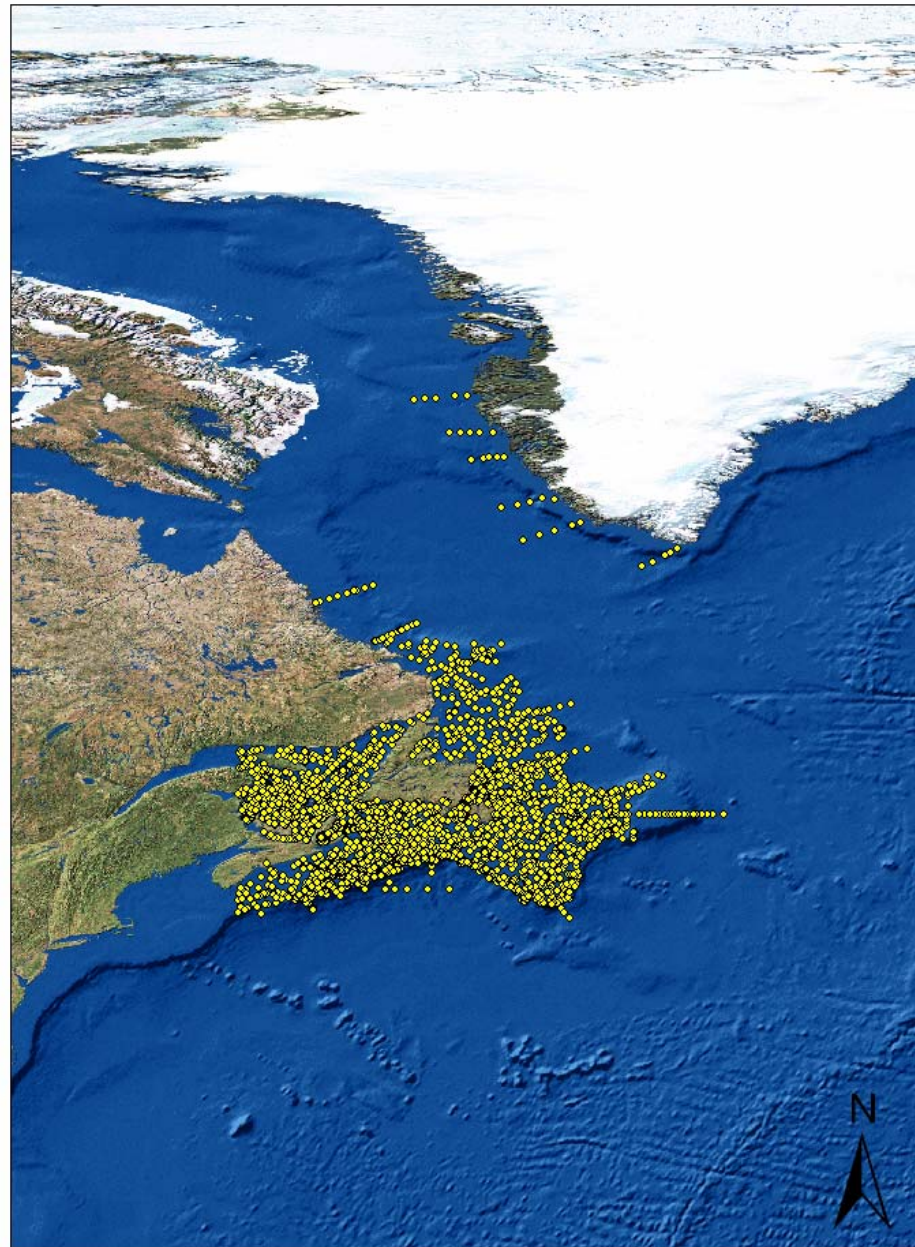
0 190 380 760 1,140 1,520 Kilometers

**Environmental  
(MEDS)**

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# CTD Temperature in 2000



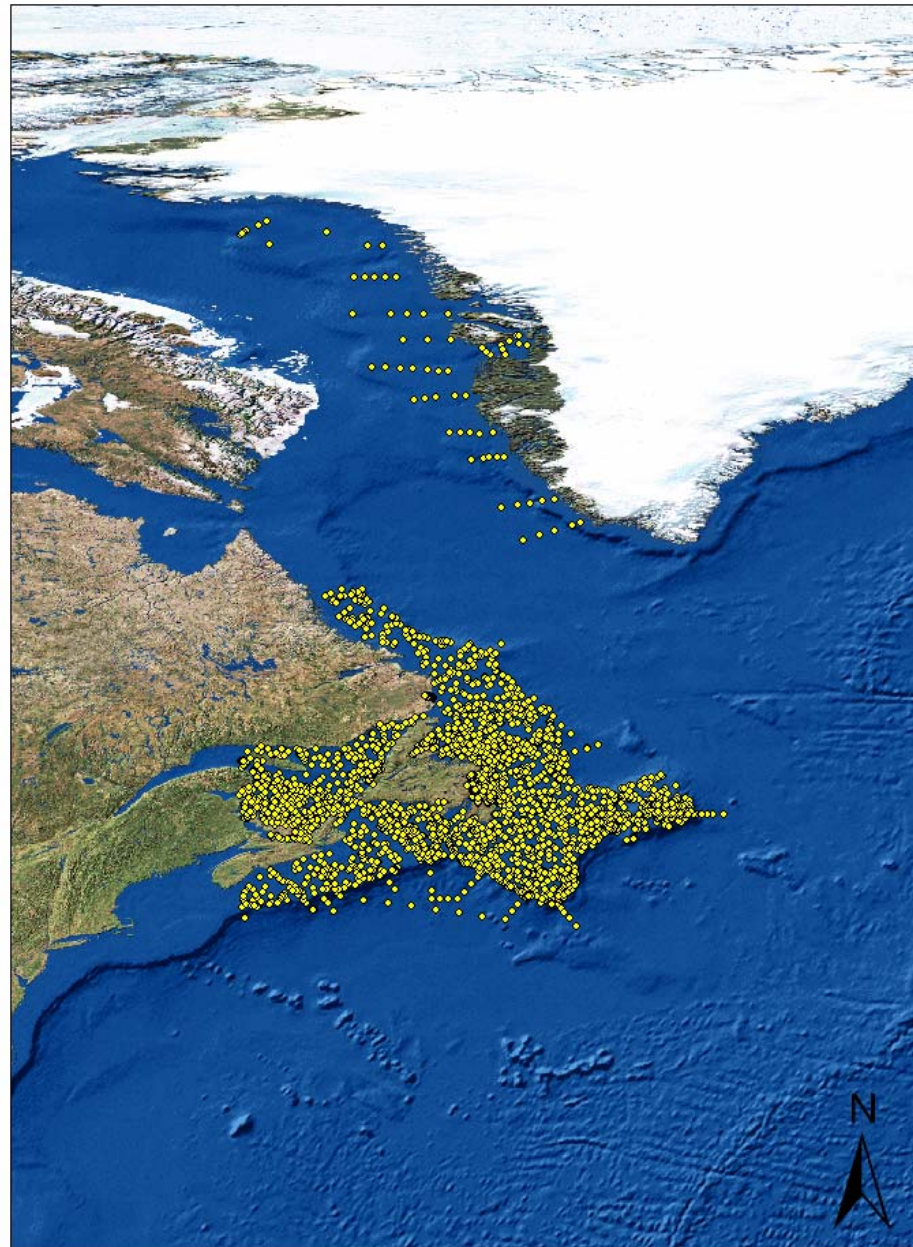
0 190 380 760 1,140 1,520 Kilometers

**Environmental  
(MEDS)**

GEOMATICS FOR THE SUSTAINABLE MANAGE  
LA GEOMATIQUE AU SERVICE DE LA GESTION



## CTD Temperature in 2004



0 190 380 760 1,140 1,520 Kilometers

**Environmental  
(MEDS)**

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LA GEOMATIQUE AU SERVICE DE LA GESTION



# Extraction of environmental data

- Environmental data were extracted for:
  - Sea surface
  - Bottom

This allows for the creation of interpolated surfaces for these two zones (cf. Randy McVeigh's talk this PM)



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# Fisheries Database : 787988 records

Data			Years											Total records	
			1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000		2005
Capelin	Newfoundland	Scientific surveys	None												
		Observer												1985 - 2005	36834
	Nova Scotia	Scientific surveys												1971 - 2006	803
		Observer	None												
	Quebec	Scientific surveys												1990 - 2005	3499
		Observer												1991 - 2005	11669
	USA	Scientific surveys												1966 - 1999	17
New Brunswick	Scientific surveys												1971-2006	4989	
			<b>57811</b>												
Cod	Newfoundland	Scientific surveys												1948 - 2006	55010
		Observer												1985 - 2005	181946
	Nova Scotia	Scientific surveys												1970 - 2006	5056
		Observer												1978 - 2006	103133
	Quebec	Scientific surveys												1990 - 2005	3499
		Observer												1993 - 2005	6733
	USA	Scientific surveys												1963 - 2005	15467
New Brunswick	Scientific surveys												1971-2006	4989	
			<b>375833</b>												
Crab	Newfoundland	Scientific surveys												1995 - 2005	12827
		Observer												1985 - 2005	69388
	Nova Scotia	Scientific surveys												1981 - 2006	1085
		Observer												1995 - 2006	28905
	Quebec	Scientific surveys												1990 - 2005	3499
		Observer												1991 - 2005	14957
	USA	Scientific surveys												1982 - 2005	52
New Brunswick	Scientific surveys												1971-2006	4989	
			<b>135702</b>												
Shrimp	Newfoundland	Scientific surveys												1995 - 2006	11160
		Observer												1985 - 2005	129991
	Nova Scotia	Scientific surveys												1998 - 2006	439
		Observer												1979 - 2006	55117
	Quebec	Scientific surveys												1990 - 2005	3499
		Observer												1991 - 2003	11905
	USA	Scientific surveys												1977 - 2003	1542
New Brunswick	Scientific surveys												1971-2006	4989	
			<b>218642</b>												
											<b>Total</b>	<b>787988</b>			

Observer data  
 Scientific surveys data



# Fisheries Database

			Years																										
Data			1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Capelin	Newfoundland	Scientific surveys					483	734	2911	3370	5912	6042	1922	1233	583	221	291	166	332	622	934	1386	1868	1461	1593	2286	2484		
		Observer					3	4	14	9	14	25	13	40	39	46	74	44	79	21	74	58	44	52	42		44	47	
	Nova Scotia	Scientific surveys																											
		Observer																											
	Quebec	Scientific surveys											191	249	240	225	188	193	231	199	223	240	224	238	186	196	123	353	
		Observer												559	1079	943	497	352	219	975	940	975	1061	846	648	858	926	791	
USA	Scientific surveys														3	2					1	1							
New Brunswick	Scientific surveys		70	65	67	108	223	173	162	154	169	147	192	169	189	160	182	208	214	206	193	198	149	185	83	226	244	176	
Cod	Newfoundland	Scientific surveys	1824	1322	1082	1320	2158	2026	1744	1785	1541	1768	1988	1581	1804	1736	1419	1651	1560	1515	1457	1416	1499	1370	1280	1566	1182	400	
		Observer					7236	8917	18253	19544	21465	20208	19012	12284	6976	1807	1470	1703	1841	3435	4225	4765	6211	6215	6470	4963	4946		
	Nova Scotia	Scientific surveys	109	121	108	102	114	169	200	183	181	217	194	175	162	165	183	149	168	107	173	186	151	159	140		151	123	
		Observer	4709	4641	4694	3912	5822	4594	7185	6685	6872	8816	5955	5195	3907	2812	1048	2355	1370	1732	1483	1943	1359	775	1231	1929	2019	3906	
	Quebec	Scientific surveys											191	249	240	225	188	193	231	199	223	240	224	238	186	196	123	353	
		Observer														246	65	155	86	259	186	1024	1005	958	648	636	800	665	
USA	Scientific surveys	480	450	436	484	325	435	352	394	322	310	322	344	458	442	528	369	295	347	296	287	180	178	265	769	669			
New Brunswick	Scientific surveys	70	65	67	108	223	173	162	154	169	147	192	169	189	160	182	208	214	206	193	198	149	185	83	226	244	176		
Crab	Newfoundland	Scientific surveys															486	1421	1291	1349	1279	1156	1264	1082	1093	1340	1066		
		Observer					104	570	410	686	1950	2960	1773	2555	1673	1970	2714	1797	2080	3379	7364	6494	6842	5896	5419	5569	7183		
	Nova Scotia	Scientific surveys	3	4	3			6	9	5	3	10	12	2	2	6	21	7	6		145	180	121	152	148		122	113	
		Observer															10	10	204	137	714	1283	2243	2069	1765	1729	1464	1190	
	Quebec	Scientific surveys											191	249	240	225	188	193	231	199	223	240	224	238	186	196	123	353	
		Observer														1934	1659	1771	1100	806	1549	1401	1669	563	557	418	362	300	631
USA	Scientific surveys		1			3			2						1		5		1			1	2	4	1	20	14		
New Brunswick	Scientific surveys	70	65	67	108	223	173	162	154	169	147	192	169	189	160	182	208	214	206	193	198	149	185	83	226	244	176		
Shrimp	Newfoundland	Scientific surveys															540	743	784	937	1236	944	1199	1151	983	1101	1310	232	
		Observer					2136	3100	3209	8934	14855	5772	9990	5370	4712	4305	4048	4133	4930	5771	6754	7843	8556	6771	6780	7561	6461		
	Nova Scotia	Scientific surveys																			2	66	72	62	68	50		55	94
		Observer	1343	861		161	204			182	2030	1255	3332	2373	2578	3491	2951	2656	3093	3280	3253	3029	2837	3028	3385	2928	3131	2866	
	Quebec	Scientific surveys											191	249	240	225	188	193	231	199	223	240	224	238	186	196	123	353	
		Observer														537	1602	1060	656	412	350	1253	1391	1201	1270	1079	1147	1094	
USA	Scientific surveys	19	13	25	35	31	41	50	58	36	53	82	98	109	75	109	65	80	111	83	66	36	44	41					
New Brunswick	Scientific surveys	70	65	67	108	223	173	162	154	169	147	192	169	189	160	182	208	214	206	193	198	149	185	83	226	244	176		

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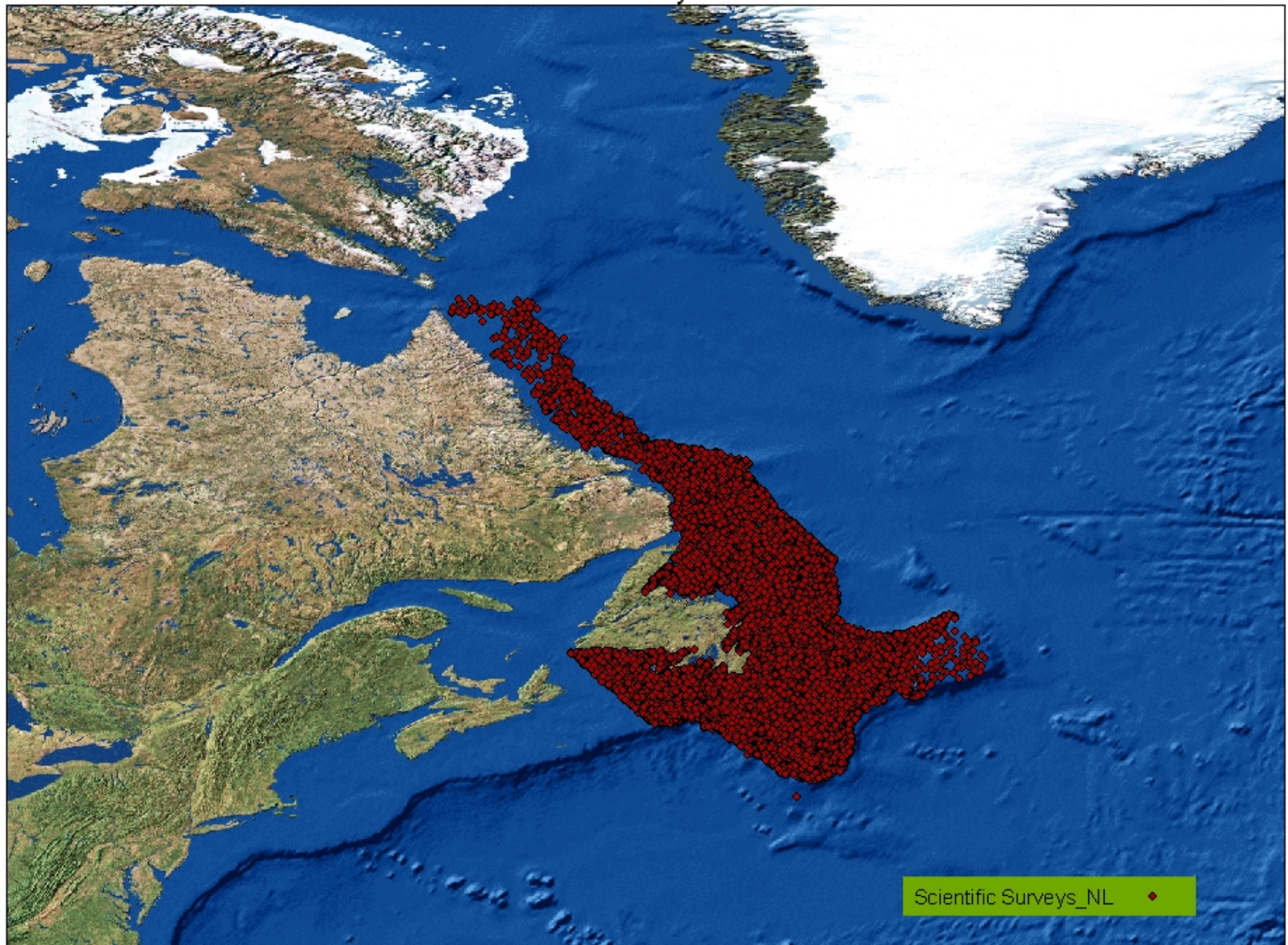
# Fisheries Scientific Surveys

GEOMATICS FOR THE SUSTAINABLE MANAGEMENT OF FISH STOCKS

LA GEOMATIQUE AU SERVICE DE LA GESTION DURABLE DES STOCKS DE POISSONS

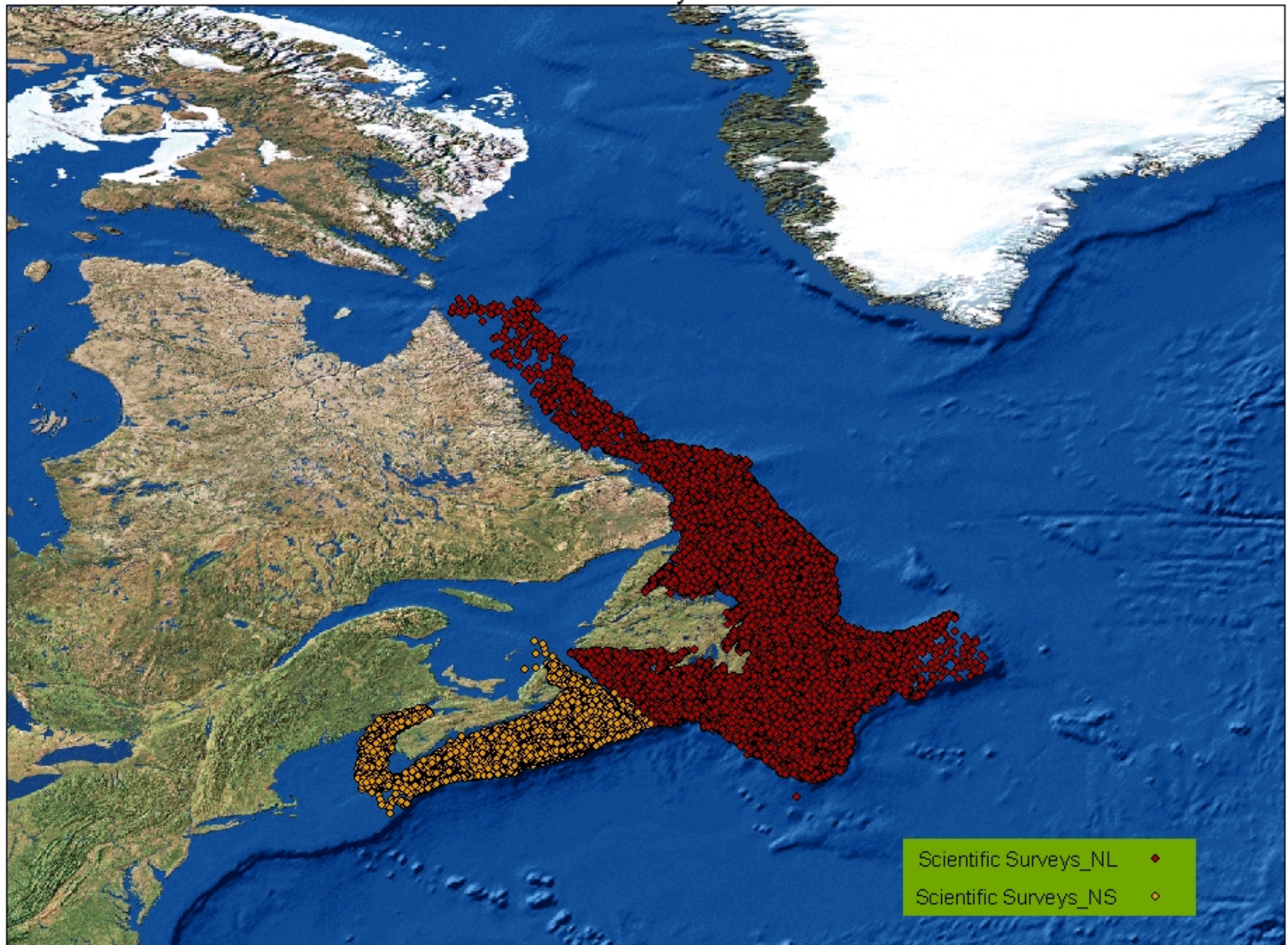


# Scientific Surveys Data



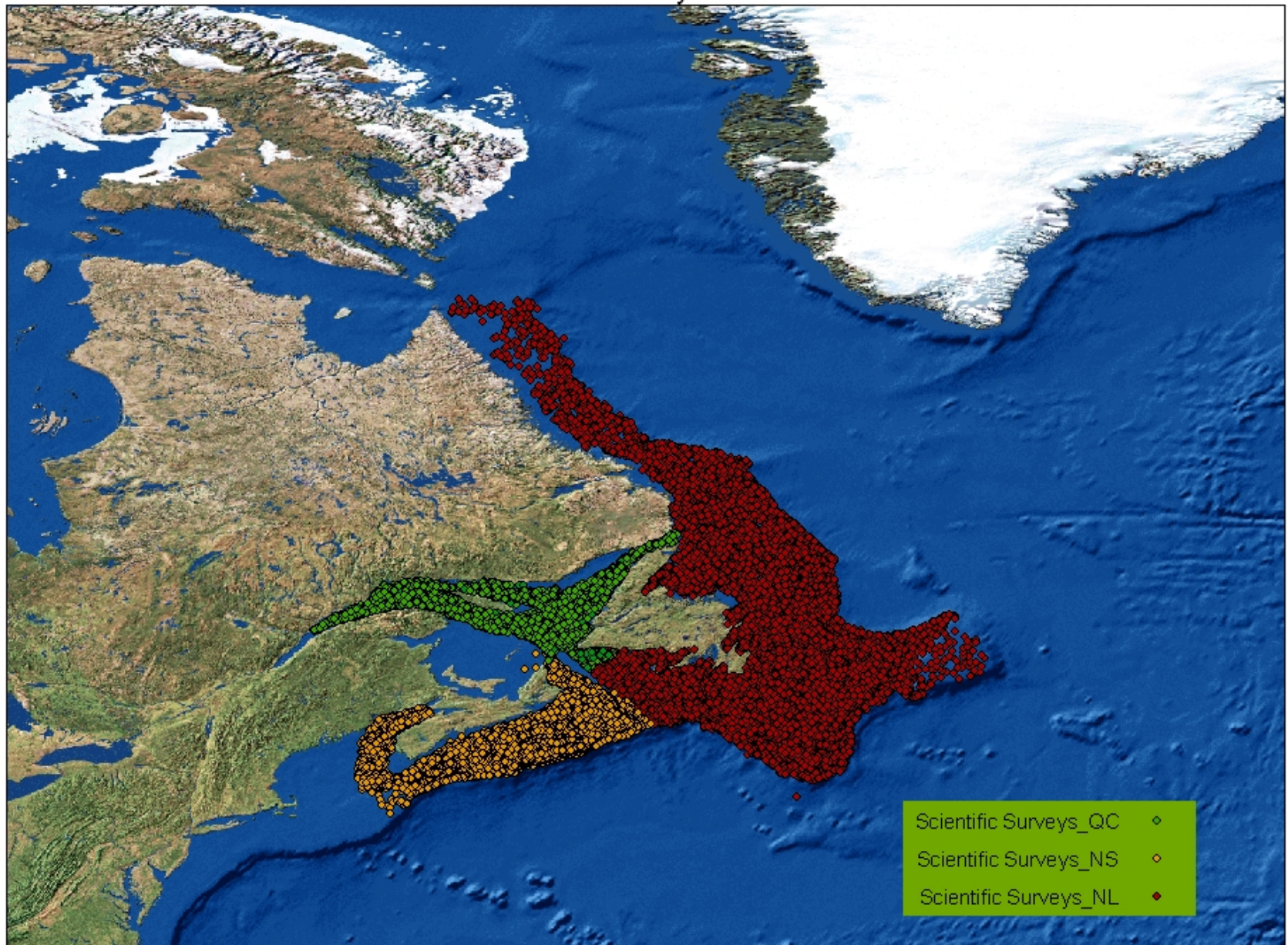
0 500 1,000 2,000 Kilometers

# Scientific Surveys Data



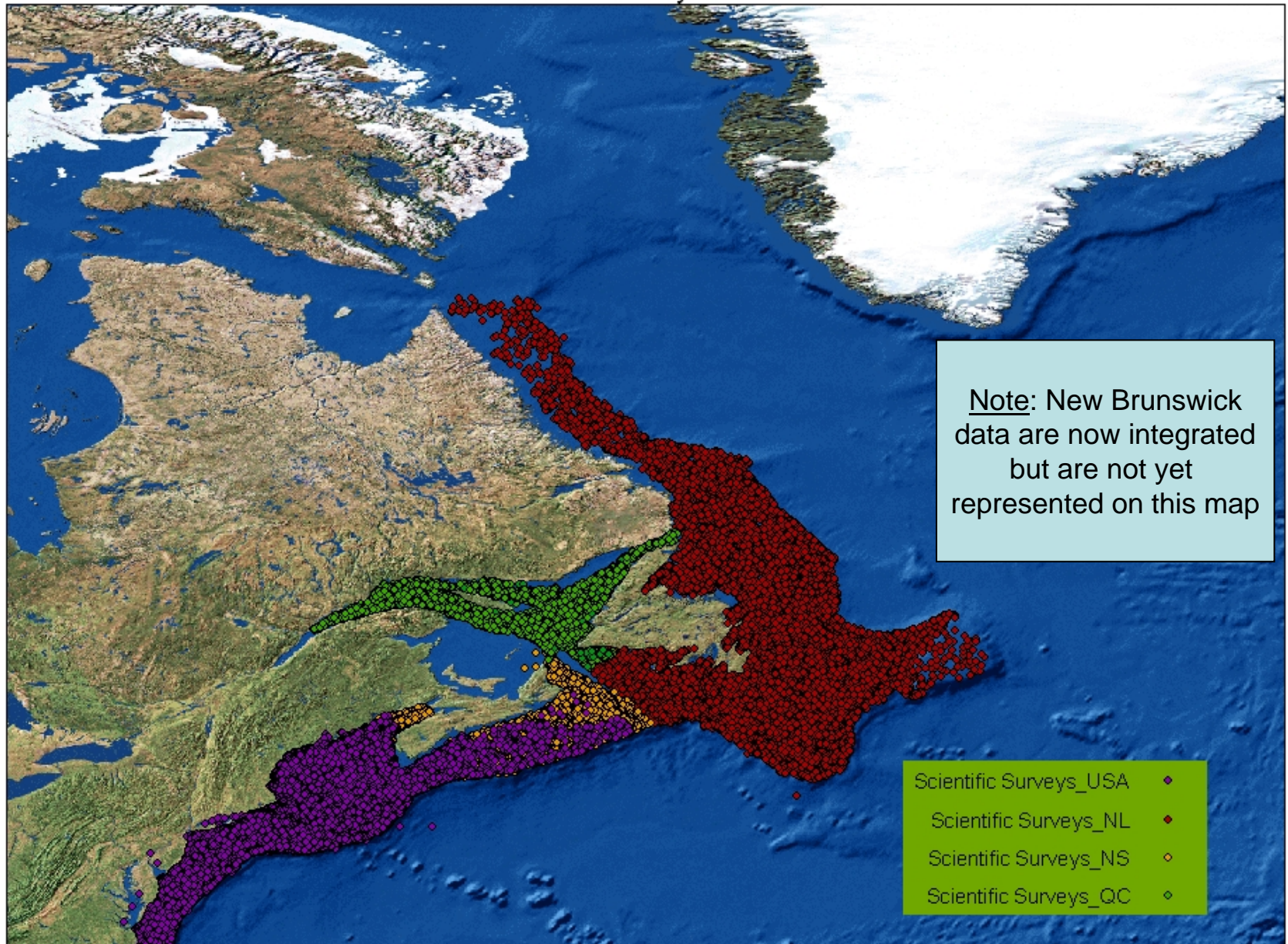
0 500 1,000 2,000 Kilometers

# Scientific Surveys Data



0 500 1,000 2,000  
Kilometers

# Scientific Surveys Data



Note: New Brunswick data are now integrated but are not yet represented on this map

- Scientific Surveys\_USA ◆
- Scientific Surveys\_NL ◆
- Scientific Surveys\_NS ◆
- Scientific Surveys\_QC ◆

0 500 1,000 2,000 Kilometers

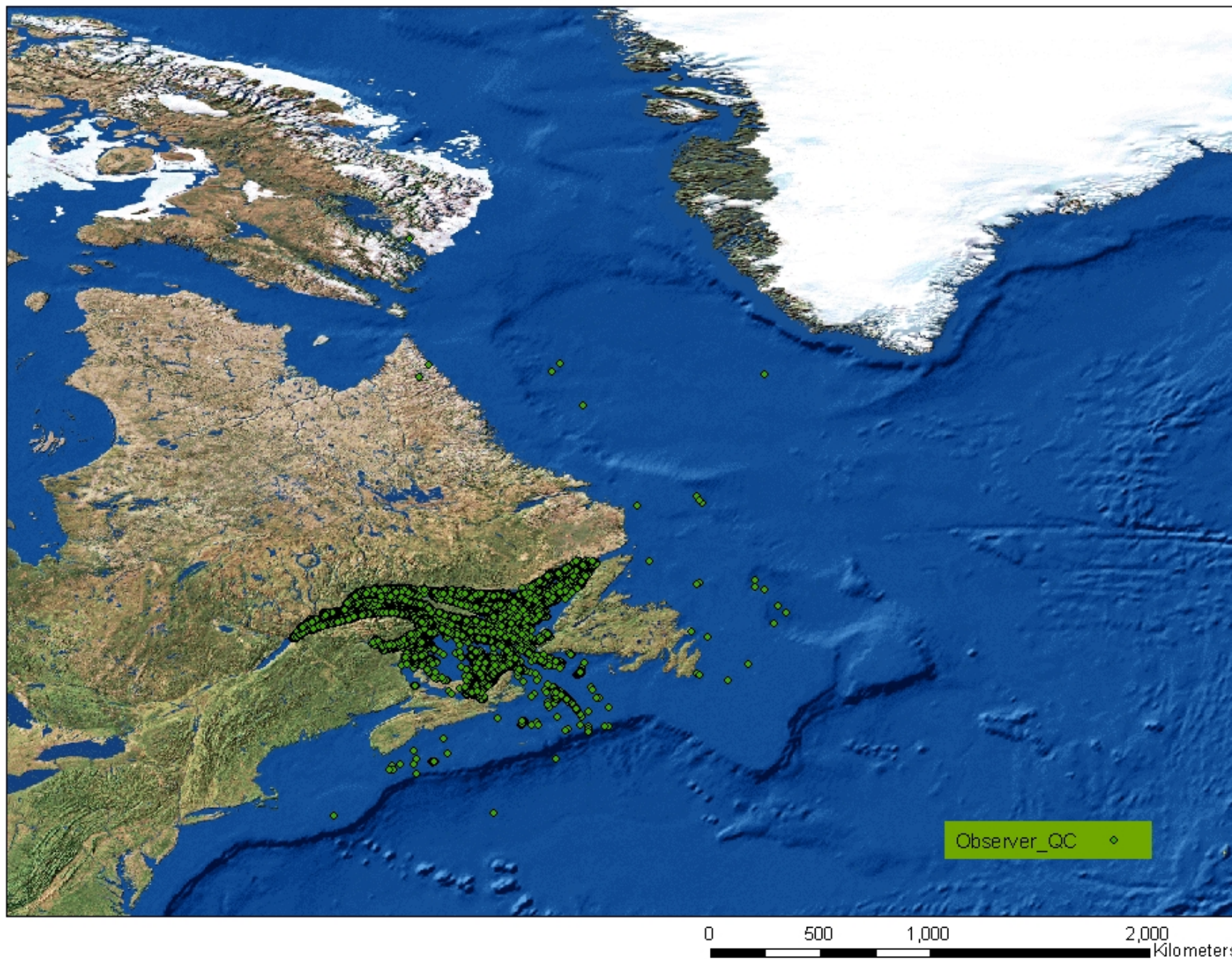
# Fisheries Observer Program

GEOMATICS FOR THE SUSTAINABLE MANAGEMENT OF FISH STOCKS

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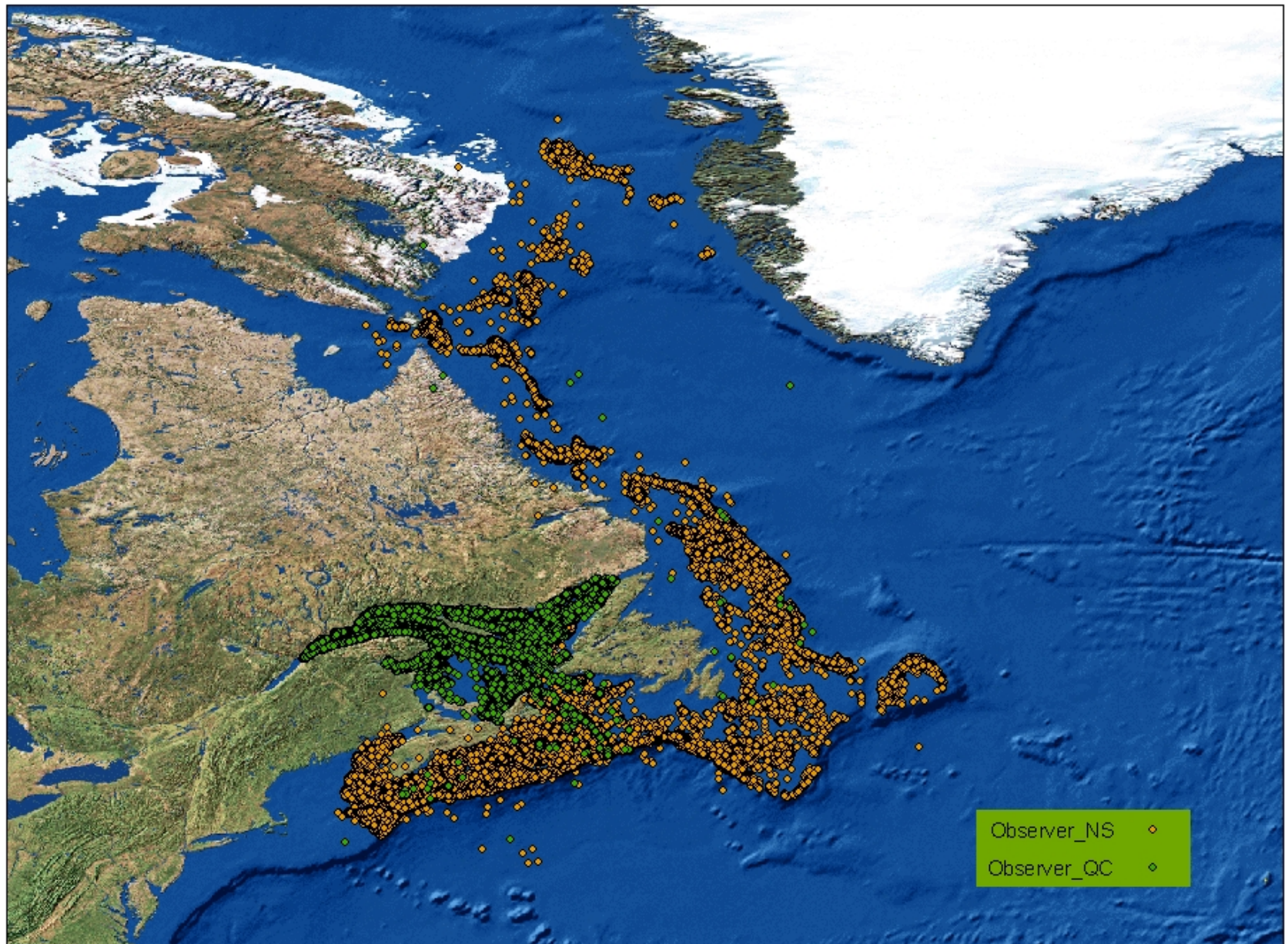


# Observer data





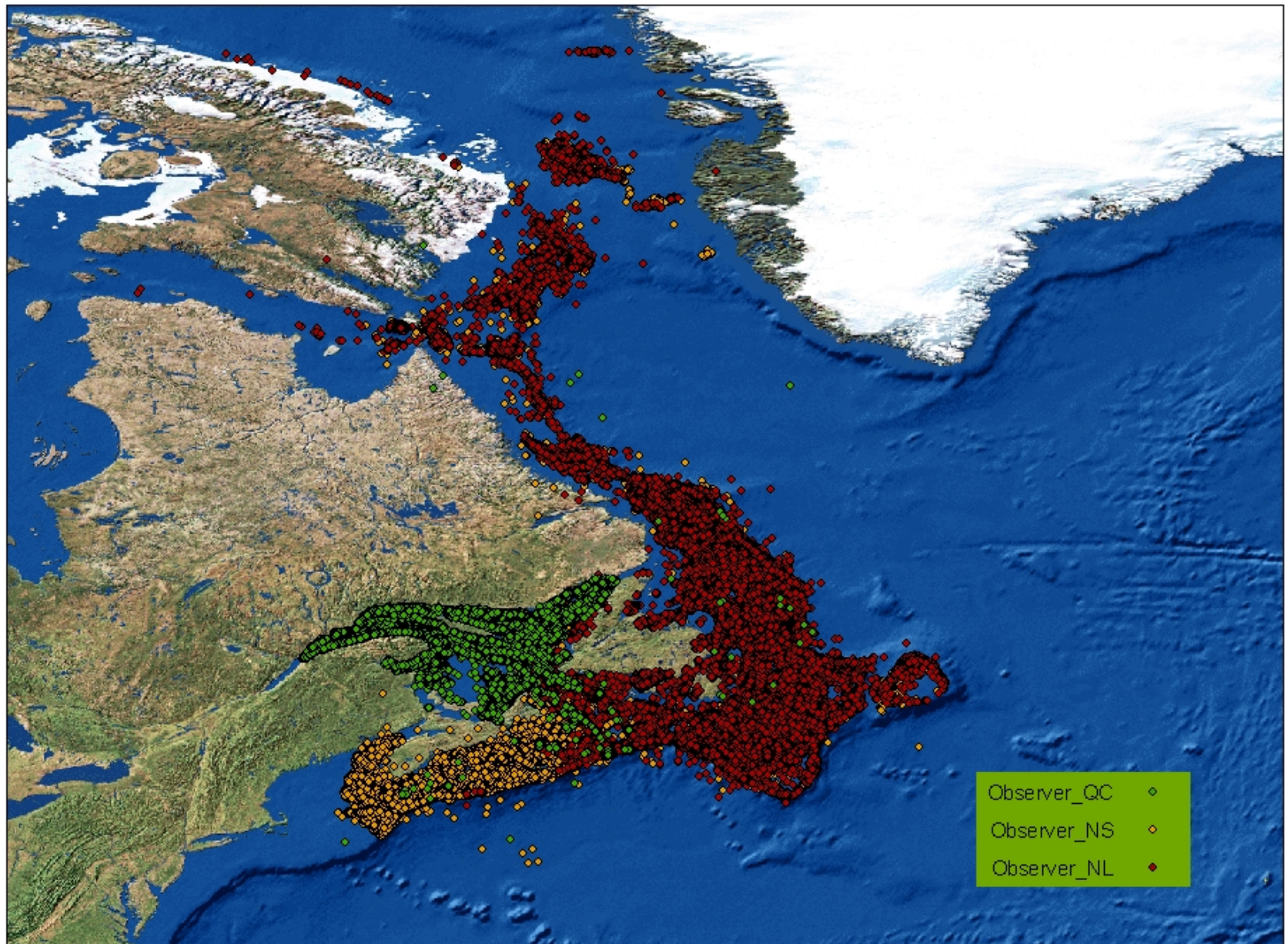
# Observer data



0 500 1,000 2,000  
Kilometers

Observer\_NS ◊  
Observer\_QC ◊

# Observer data



- Observer\_QC ◊
- Observer\_NS ◊
- Observer\_NL ◊

0 500 1,000 2,000 Kilometers

# Outline

- Objective
- Integrated Database
- Environmental Data
- Fisheries Data
- **Metadata**
- Conclusions



# Documenting the data: Metadata

The screenshot displays the ArcCatalog interface. The title bar reads "ArcCatalog - ArcEditor - WGeocod\geocod\Data\Fish\Fish\_Geodatabase.mdb\Observer\_NovaScotia\_Cod\_1978". The menu bar includes "File", "Edit", "View", "Go", "Tools", "Window", and "Help". The toolbar contains various icons for file operations and navigation. The "Location" field shows the path "\\Geocod\geocod\Data\Fish\Fish\_Geodatabase.mdb\Observer\_NovaScotia\_Cod\_1978" and the "Stylesheet" is set to "FGDC ESRI".

The left pane shows a tree view of feature classes, with "Observer\_NovaScotia\_Cod\_1978" selected. The right pane displays the metadata for this feature class, titled "Observer\_NovaScotia\_Cod\_1978" and "Personal GeoDatabase Feature Class". The metadata is organized into sections:

- Description**
  - Keywords**
    - Theme:** Fish data
    - Place:** North-West Atlantic region
  - Description**
    - Abstract**

The At-Sea Observer Program is a program to place approved private sector observers aboard fishing vessels to report on activities and to collect biological samples.
    - Purpose**

Fisheries information.
  - Status of the data**
    - In work
    - Data update frequency:* Annually
  - Time period for which the data is relevant**
  - Publication Information**
- Data storage and access information**
  - File name:* Observer\_NovaScotia\_Cod\_1978
  - Type of data:* vector digital data
  - Location of the data:*
    - \\Geocod\geocod\Data\Fish\Fish\_Geodatabase.mdb
  - Data processing environment:* Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 2; ESRI ArcCatalog 9.1.0.722
- Constraints on accessing and using the data**
  - Use constraints:*

This dataset should only be used within the context of the GeoCod project.
- Details about this document**

# Metadata

The screenshot shows the ArcCatalog interface. The title bar reads "ArcCatalog - ArcEditor - \\Geocod\geocod\Data\Fish\Fish\_Geodatabase.mdb\SS\_USA\_Capelin\_1966". The menu bar includes "File", "Edit", "View", "Go", "Tools", "Window", and "Help". The toolbar contains various icons for file operations and navigation. The "Location" field shows the path "\\Geocod\geocod\Data\Fish\Fish\_Geodatabase.mdb\SS\_USA\_Capelin\_1966". The "Stylesheet" is set to "FGDC ESRI".

The main window is divided into two panes. The left pane shows a tree view of the geodatabase contents, with "SS\_USA\_Capelin\_1966" selected. The right pane displays the metadata for this feature class, with tabs for "Contents", "Preview", and "Metadata". The "Metadata" tab is active, showing the following information:

**SS\_USA\_Capelin\_1966**  
Personal GeoDatabase Feature Class

**Description** | **Spatial** | **Attributes**

**Details for SS\_USA\_Capelin\_1966**  
*Type of object:* Feature Class  
*Number of records:* 4

**Attributes**

**OBJECTID**  
**Shape**

**CRUISE6**  
*Alias:* CRUISE6  
*Data type:* String  
*Width:* 50  
*Precision:* 0  
*Scale:* 0  
*Definition:*  
Code uniquely identifying the cruise. The first four digits indicate the year and the last two digits uniquely identify the cruise within the year.

**STRATUM**  
*Alias:* STRATUM  
*Data type:* String  
*Width:* 50  
*Precision:* 0  
*Scale:* 0  
*Definition:*  
A predefined area where a net dredge, or other piece of gear was deployed.

**TOW**  
*Alias:* TOW  
*Data type:* String  
*Width:* 50  
*Precision:* 0  
*Scale:* 0  
*Definition:*  
Sequential number representing order in which station was selected within a stratum.

**STATION**  
*Alias:* STATION  
*Data type:* String



Location: \\Geocod\geocod\Data\Fish\Fish\_Geodatabase.mdb\Observer\_Newfoundland\_Cod\_2005

Stylesheet: FGDC ESRI

- Fish\_Geodatabase
  - Listing
    - Observer\_Newfoundland\_Capelin\_1985
    - Observer\_Newfoundland\_Capelin\_1986
    - Observer\_Newfoundland\_Capelin\_1987
    - Observer\_Newfoundland\_Capelin\_1988
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    - Observer\_Newfoundland\_Capelin\_2004
    - Observer\_Newfoundland\_Capelin\_2005
    - Observer\_Newfoundland\_Cod\_1985
    - Observer\_Newfoundland\_Cod\_1986
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    - Observer\_Newfoundland\_Cod\_2004
    - Observer\_Newfoundland\_Cod\_2005
    - Observer\_Newfoundland\_Crab\_1985
    - Observer\_Newfoundland\_Crab\_1986
    - Observer\_Newfoundland\_Crab\_1987
    - Observer\_Newfoundland\_Crab\_1988
    - Observer\_Newfoundland\_Crab\_1989
    - Observer\_Newfoundland\_Crab\_1990
    - Observer\_Newfoundland\_Crab\_1991
    - Observer\_Newfoundland\_Crab\_1992

Contents Preview Metadata

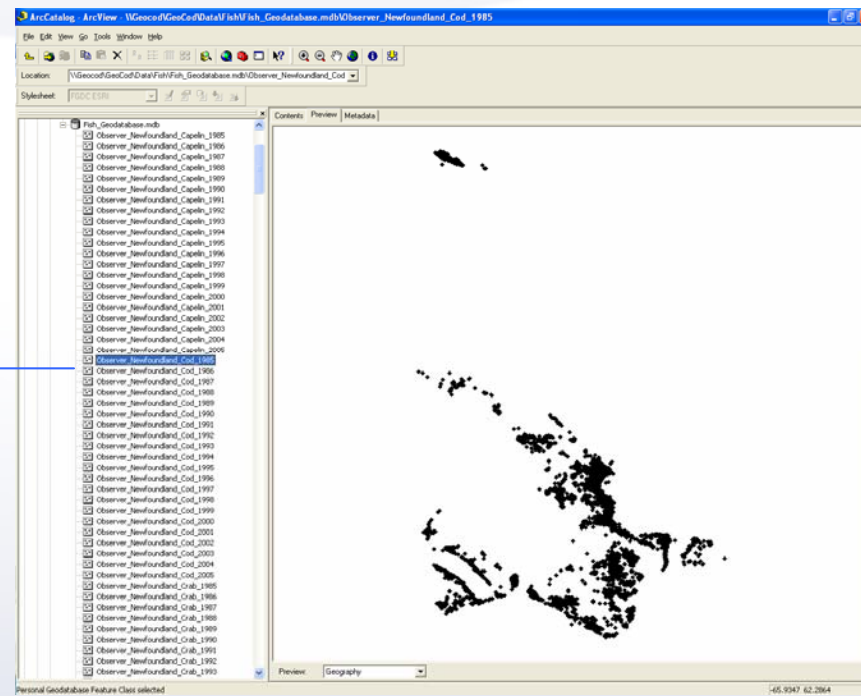


Preview: Geography

# Fisheries Geodatabase

- Integrated fisheries database

- 1 { Scientific surveys  
Observer
- 2 { Newfoundland  
Nova Scotia  
Quebec  
USA
- 3 { Cod  
Capelin  
Crab  
Shrimp
- 4 { Year



- 1
- 2
- 3
- 4



# Conclusions

- Outside some specific cases, all the data we wanted to bring together are now integrated in a same database = the first objective of the project is reached
- Long and painful process (more than a year) but will allow very diverse analyses
- The availability of this database allows now other teams to work on the analysis (Toronto, Laval, MI)





# Questions?



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# Scientific Surveys (Shrimp)

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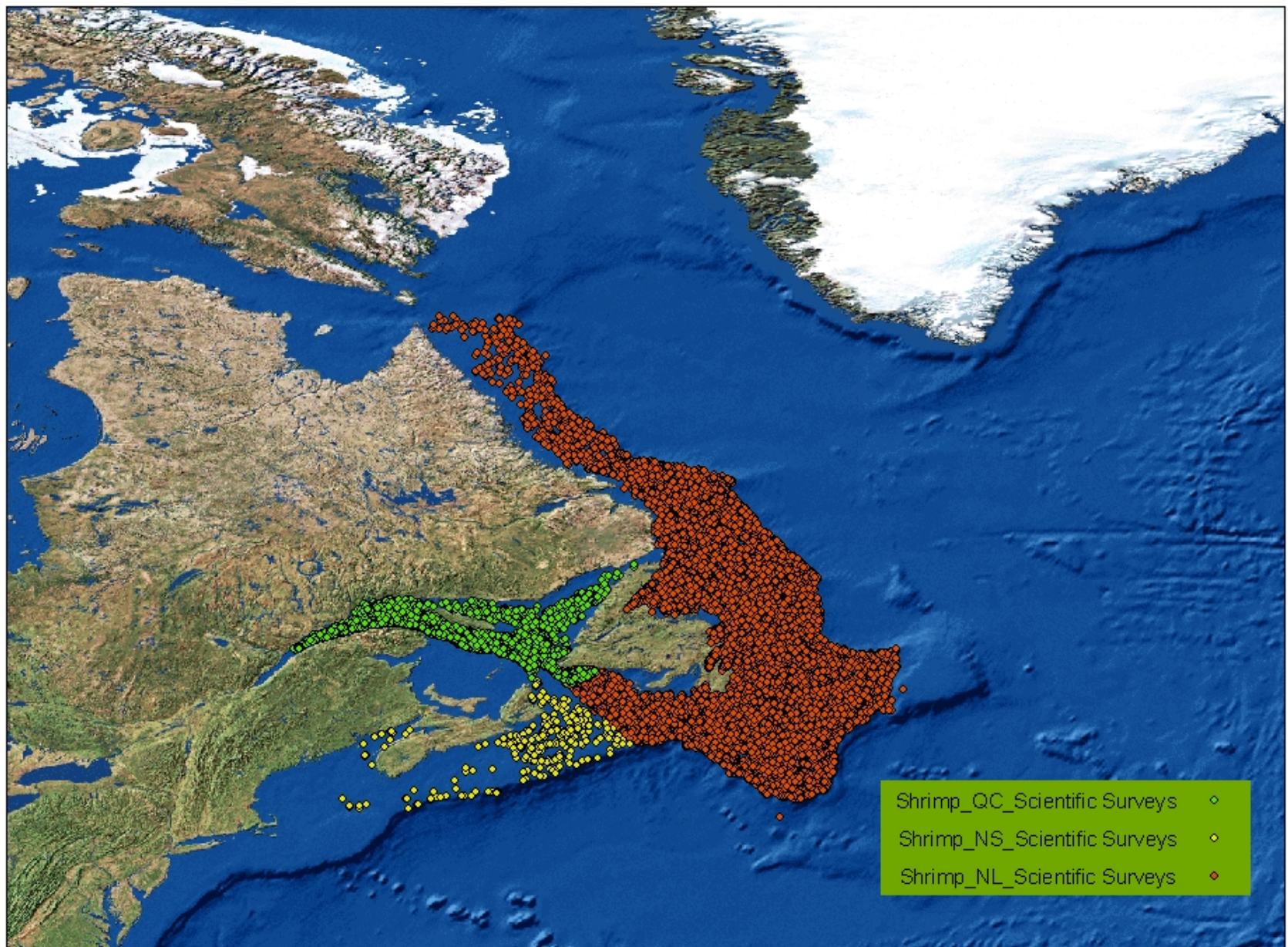




0 500 1,000 2,000 Kilometers



0 500 1,000 2,000 Kilometers



0 500 1,000 2,000 Kilometers

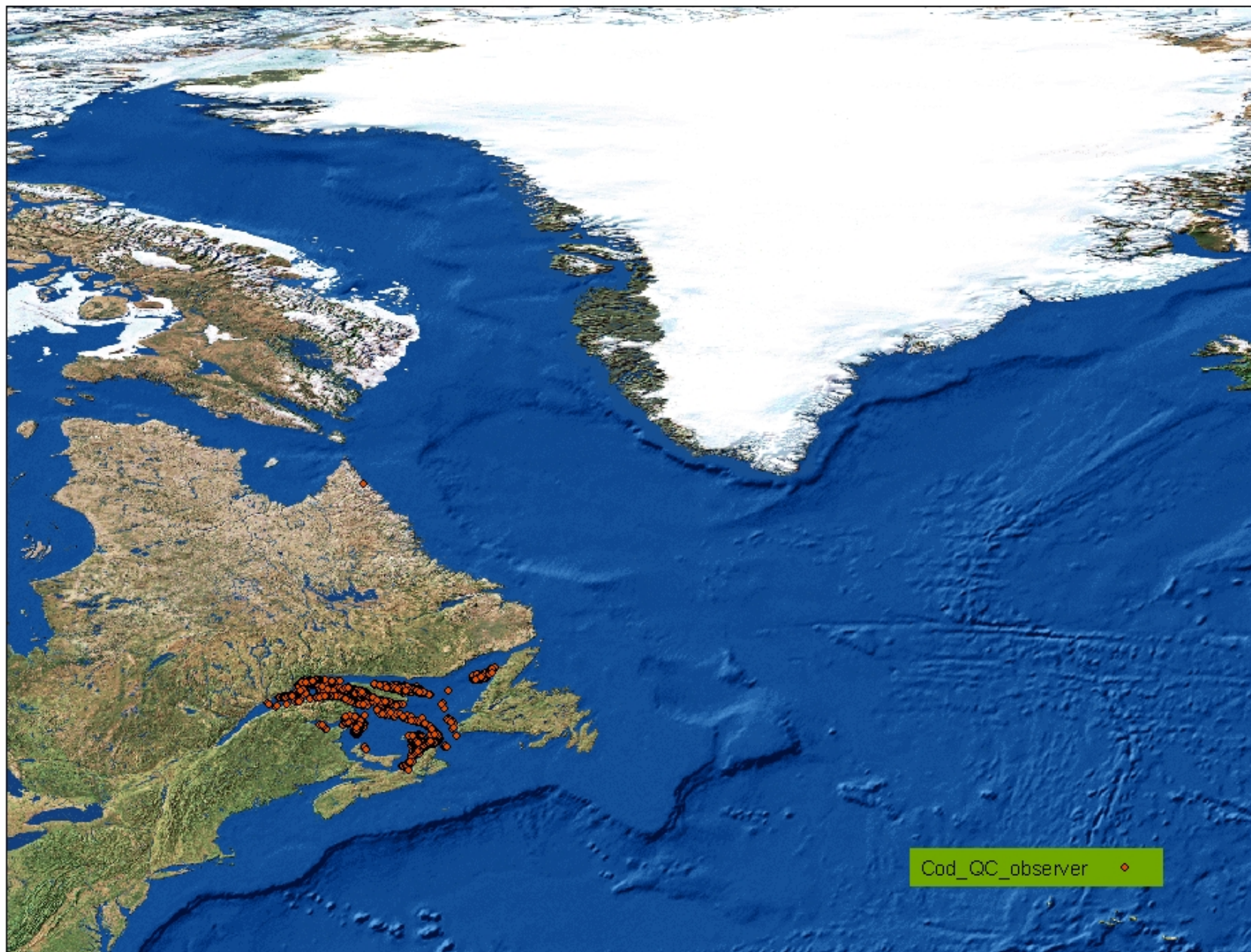
# Fisheries Observers (Cod)

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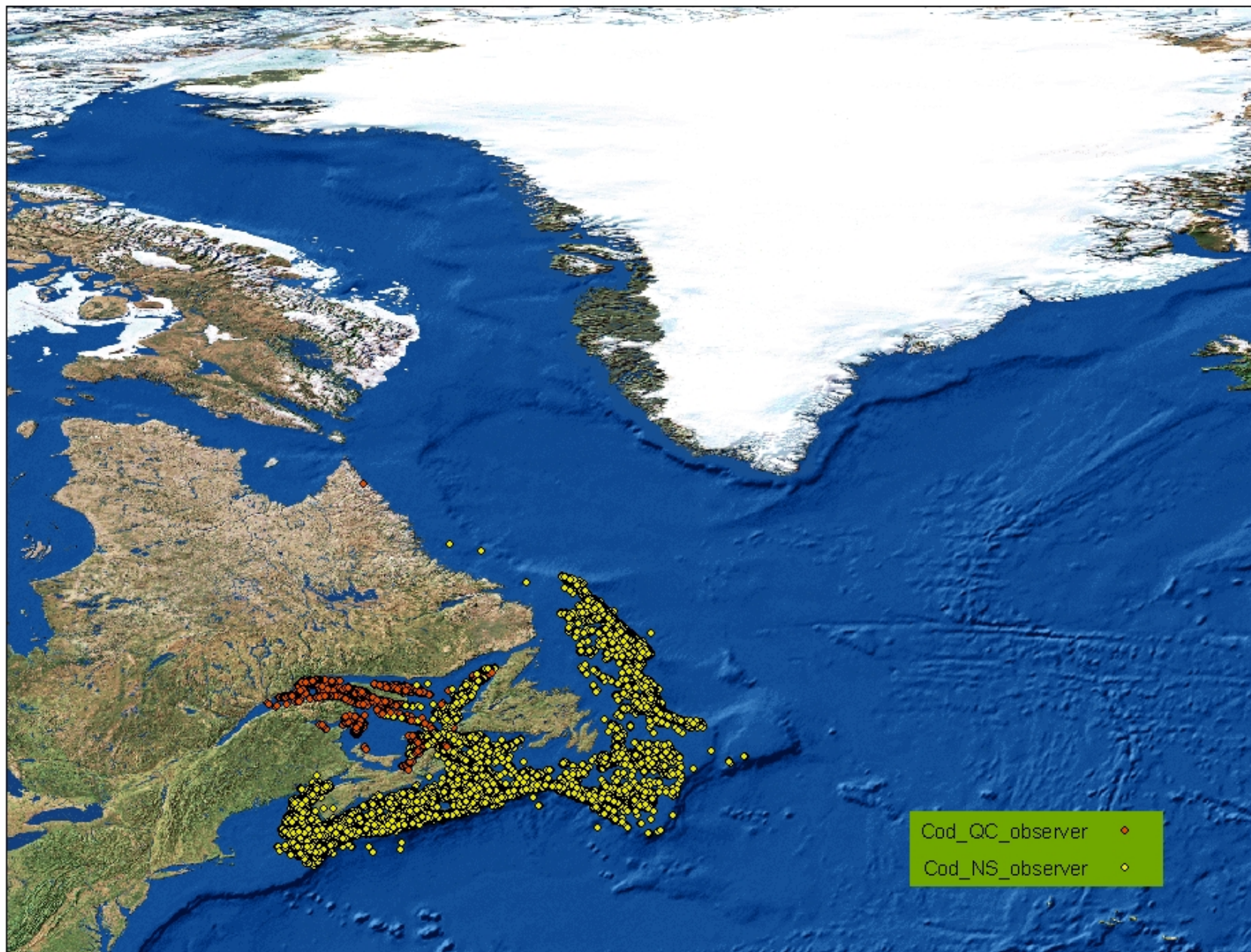
# Data Observer Cod



0 500 1,000 2,000  
Kilometers



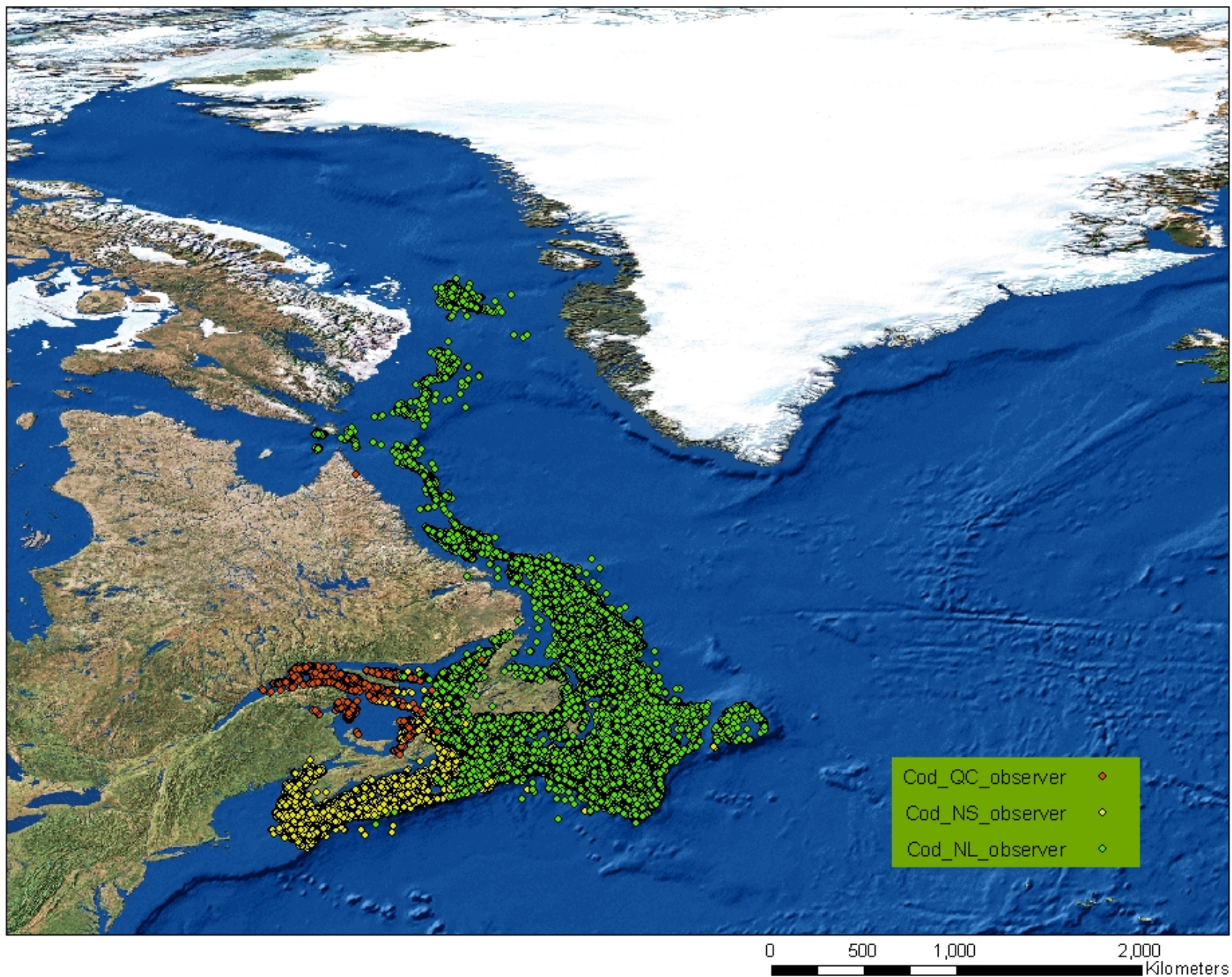
# Data Observer Cod



Cod\_QC\_observer ◊  
Cod\_NS\_observer ◊

0 500 1,000 2,000 Kilometers

# Data Observer Cod



# Fisheries Observers (Crab)

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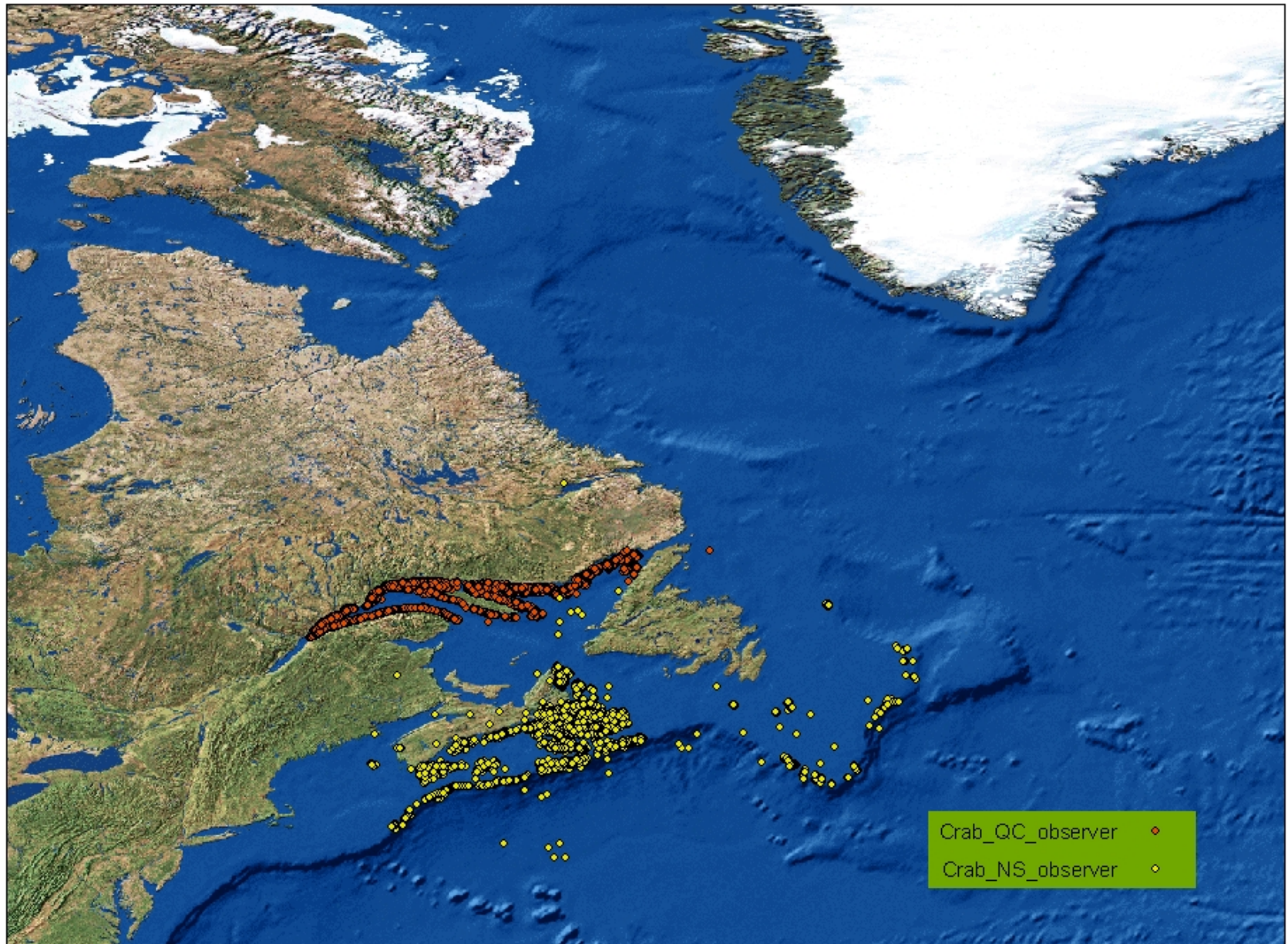


# Data Observer Crab



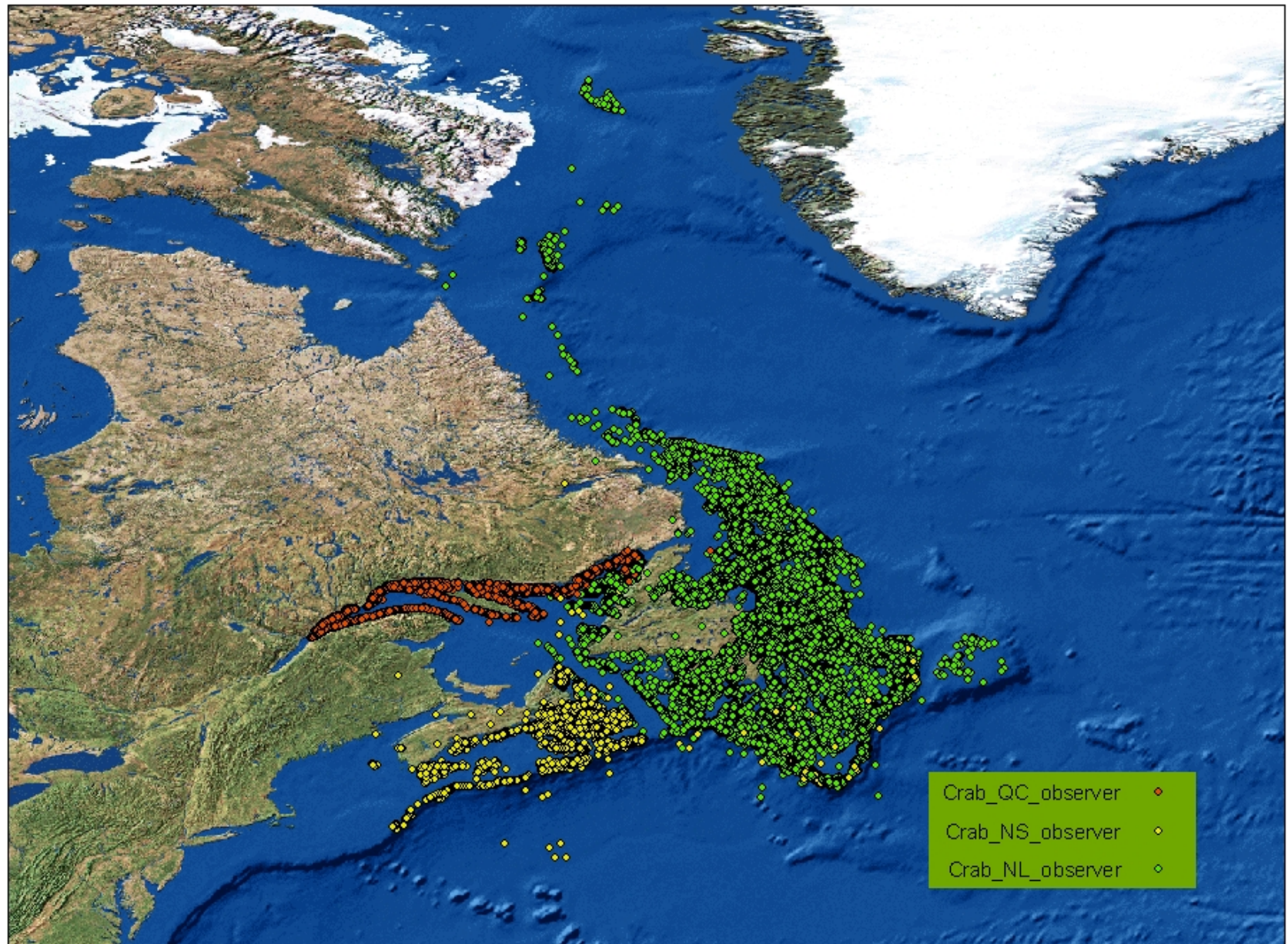
0 500 1,000 2,000 Kilometers

# Data Observer Crab



0 500 1,000 2,000 Kilometers

# Data Observer Crab



0 500 1,000 2,000 Kilometers