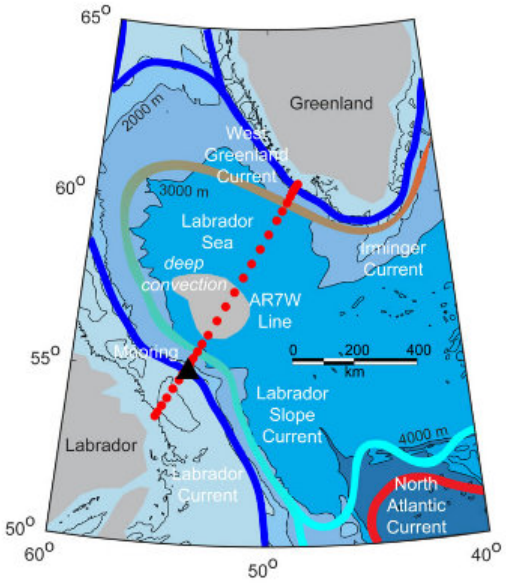
Labrador Sea Monitoring Program



AR7W station positions (red dots) in relation to oceanographic features in the Labrador Sea region.

CCGS Hudson which carries out the AR7W survey

The Labrador Sea Monitoring Program of Fisheries and Oceans Canada (DFO) collects and analyzes physical, chemical and biological oceanographic observations on a line of stations across the Labrador Sea. The line, referred to as AR7W, is the Atlantic Repeat Hydrography Line 7 West of the 1990-2002 World Ocean Circulation Experiment (WOCE). It has been occupied annually (typically in May) since 1990, with biological measurements since 1994. AR7W extends from Hamilton Bank on the Labrador Shelf to Cape Desolation on the Greenland Shelf. The present program is a DFO contribution to the Global Ocean Observation System (GOOS) and the International Ocean Carbon Coordination Project (IOCCP).

Oceanographic conditions and atmosphere-ocean interactions in the Labrador Sea are of particular importance because:

a. It is one of the few areas of the global ocean where intermediate-depth water masses are formed through the convective sinking of dense surface water. This transports carbon dioxide and other important ocean properties to the lower limb of the ocean's Meridional Overturning Circulation (MOC) (sometimes referred to as the "global ocean conveyor belt").
b. It is a key region for the forcing and modification of the Labrador Current system which has a major influence on oceanographic and ecosystem conditions on the Atlantic Canadian shelf.

The Physical Oceanographic component focuses on interannual variability in water mass properties and circulation, and related atmospheric and ice conditions.

The Chemical Oceanographic component focuses on nutrients, the carbon cycle, carbon dioxide storage, and chemical tracers which indicate circulation patterns and rates.

The Biological Oceanographic component focuses on lower-trophic-level (bacteria, phytoplankton, zooplankton) biomass, productivity and biogenic carbon inventories (particulate and dissolved organic carbon).

Datasets are provided to the international CLIVAR and Carbon Hydrographic Data Office (CCHDO) and the Carbon Dioxide International Analysis Center (CDIAC), as well as to DFO's Integrated Science and Data Management (ISDM).

Summary reports on recent (2009) conditions in the Labrador Sea are available from DFO's AZMP Bulletin No. 9 and Scientific Research Document 10\17 of the NAFO Scientific Council.

For the distributions of key properties in recent years, see Recent Oceanographic Conditions in the Labrador Sea.

For related climate research, see Labrador Sea in the NW Atlantic. For related ecosystem research, see Ecosystem Research.

▼ Physical

Physical Oceanographic Monitoring of the Labrador Sea

This component examines interannual variability in physical environmental conditions in the Labrador Sea region, including water mass properties, circulation, stratification, and related atmospheric and ice conditions. Strong atmospheric cooling in winter results in the formation or modification of intermediate-depth water masses such as Labrador Sea Water. These are important to the ocean's "Meridional Overturning Circulation (MOC)", sometimes referred to as the "global ocean conveyor belt" of the coupled atmosphere-ice-ocean climate system. Modifications of the Labrador Current system are important to both the shelf waters off Atlantic Canada and the broader-scale North Atlantic.

Measurements include:

a. temperature, salinity and density profiles at a fixed set of stations on the AR7W line from a Conductivity-Temperature-Depth (CTD) system
b. additional upper-ocean temperature profiles from eXpendable BathyThermographs (XBTs)
c. upper-ocean currents from a Vessel-Mounted Acoustic Doppler Current Profiler (VM-ADCP)
d. moored measurements of near-bottom temperature and currents on the 1000-m isobath on the Labrador Slope.

The processed CTD and XBT data are available from OSD's Climate Database.

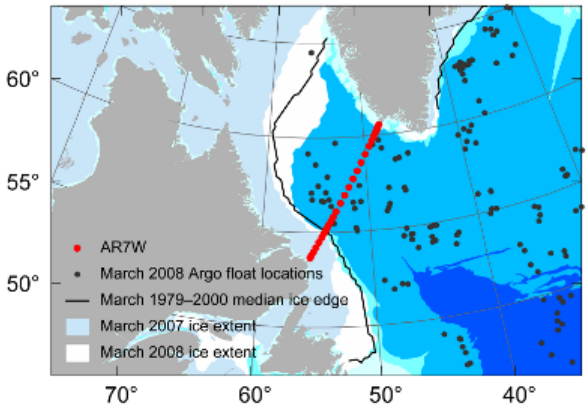
The current-meter data are available from OSD's Ocean Data Inventory (ODI).

For the temperature, salinity and density distributions observed in recent years, see Recent Oceanographic Conditions in the Labrador Sea .

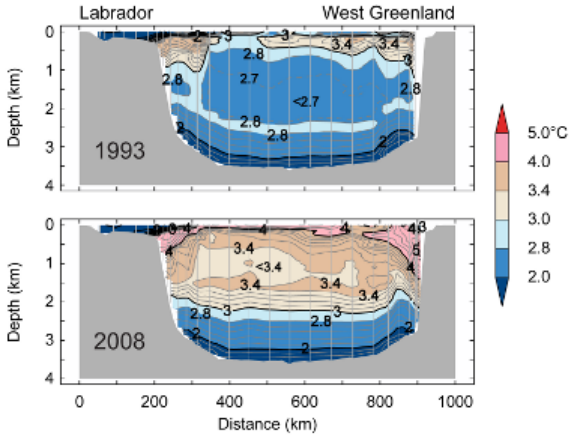
Final datasets are provided to the international CLIVAR and Carbon Hydrographic Data Office (CCHDO), as well as to DFO's Integrated Science and Data Management (ISDM).

Information on related Ocean Climate Research can be found under:

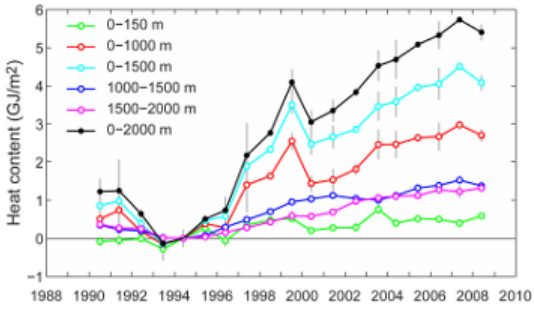
a. Ocean Climate and Variability: Labrador Sea in the NW Atlantic
b. Ocean Climate and Variability: Linkages to the Atlantic Meridional Overturning Circulation (AMOC)



Location of AR7W stations, Argo profiles in March 2008, and sea-ice extent in March 2007 and 2008.



Temperature distributions on the AR7W Line, showing warming from 1993 to 2008.



Increasing heat content in various depth intervals in the central Labrador Sea.

▼ Chemical

Chemical Oceanographic Monitoring of the Labrador Sea

This component focuses on nutrients, the carbon cycle, carbon dioxide storage, and chemical tracers which indicate circulation patterns and rates. These are relevant to both the regional ecosystem and the global climate system.

Measurements include:

a. dissolved oxygen profiles from a Conductivity-Temperature-Depth (CTD) system

b. dissolved oxygen and nutrients, alkalinity and carbonate, and chlorofluorocarbon (CFC) tracers from rosette bottles at selected depths

The observations provide indices of the changes in dissolved oxygen in the Labrador Sea since the early 1990s and of carbon variables since the mid 1990s. There are clear trends with oxygen decreasing, total inorganic carbon increasing and pH decreasing

The processed CTD data are available from OSD's Climate Database.

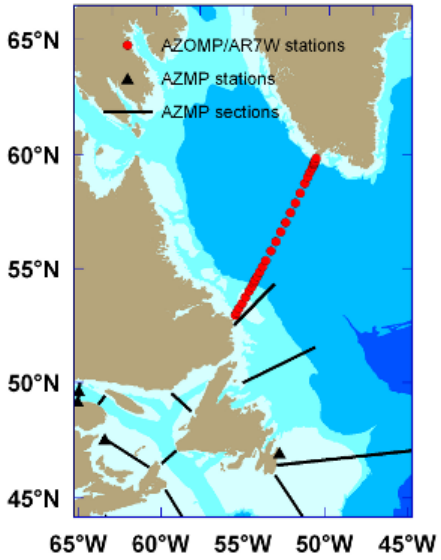
The bottle data are available from BIOCHEM.

For oxygen, nutrient, carbon and CFC distributions observed in recent years, see Recent Oceanographic Conditions in the Labrador Sea.

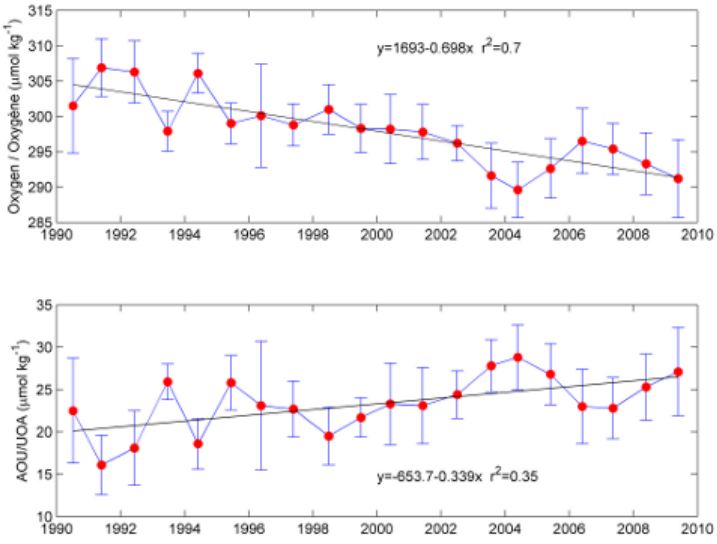
Datasets are provided to the international CLIVAR and Carbon Hydrographic Data Office (CCHDO) and the Carbon Dioxide International Analysis Center (CDIAC), as well as to DFO's Integrated Science and Data Management (ISDM).

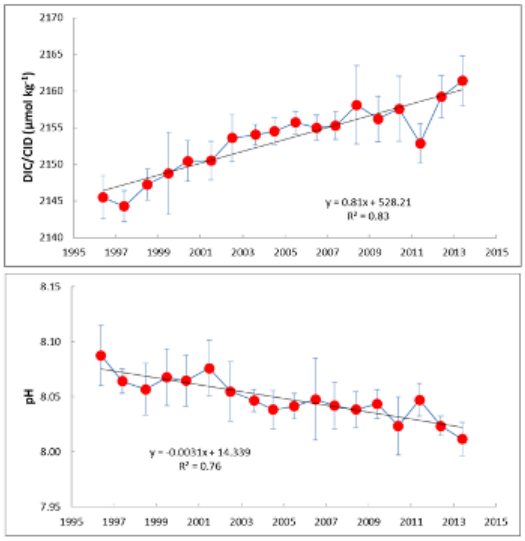
Information on related Ocean Climate Research can be found under:

a. Ocean Climate and Variability: Labrador Sea in the NW Atlantic



Locations of the AR7W stations in the Labrador Sea, and AZMP stations and sections.

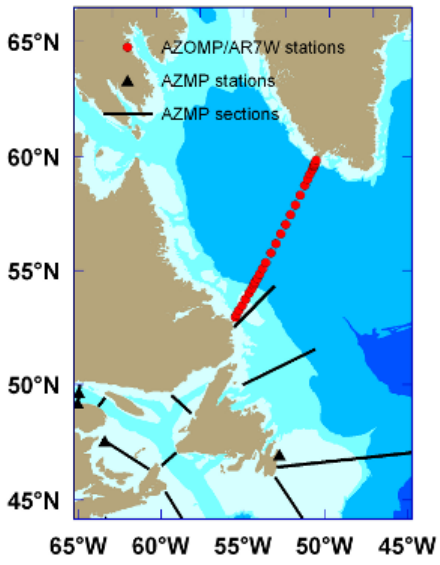




Time series of variability in the central Labrador Sea of dissolved oxygen and apparent oxygen utilization (AOU) (left), and total inorganic carbon (TIC) and pH (right panel).

▼ Biological

Biological Oceanographic Monitoring of the Labrador Sea



Locations of the AR7W stations in the Labrador Sea, and AZMP stations and sections.

This component focuses on large-scale (spatial and temporal) variability in plankton biomass, productivity and biogenic carbon inventories. The aims are to provide descriptions of:

a. the inventories in and export of biogenic carbon from the Labrador Sea, their turnover rates and variability in space and time as part of DFO's climate-related studies on biological feedbacks to the climate system, and
b. plankton life-cycles and productivity in the Labrador Sea and their influence or contribution to ecosystems downstream in support of DFO's ecosystem-related research on status and trends of lower trophic levels in Atlantic Canadian waters.

Measurements from rosette bottle casts, plankton net tows or satellites include:

a. phytoplankton biomass and primary productivity,
b. microbial (bacteria and picophytoplankton) biomass and productivity,
c. mesozooplankton biomass, egg production and grazing, and
d. dissolved and particulate organic carbon and microbial community respiration.

Satellite ocean colour representation of the annual growth cycle of phytoplankton in the NW Atlantic.

a. Winter - Phytoplankton abundance is low throughout the NW Atlantic, but particularly so in the Labrador Sea, due to ice-cover (shallow Labrador Shelf waters), short days and low light levels.
b. Spring - Rapid phytoplankton growth begins (the so-called spring phytoplankton "bloom") at temperate latitudes (e.g. off the Scotian Shelf) and in the northeastern Labrador Sea, off the coast of Greenland.
c. Summer - Maximum phytoplankton abundance occurs in the central Labrador Sea.
d. Autumn - A second "pulse" of phytoplankton growth occurs in shallow shelf waters on the Labrador coast.

In recent years, a Pelagic Bird Survey has been carried out during the annual AR7W survey by Environment Canada's Canadian Wildlife Service (CWS).

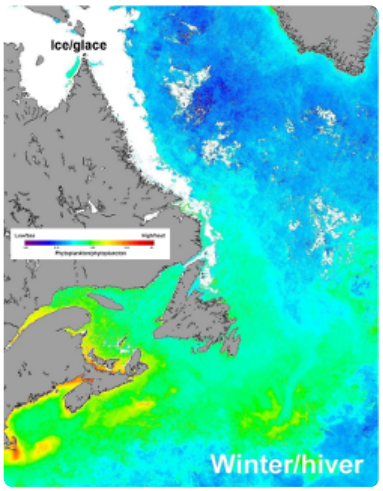
The processed biological data from in situ measurements are available from BIOCHEM.

The processed ocean colour data from satellite measurements are available from AZMP's Ocean Colour Database.

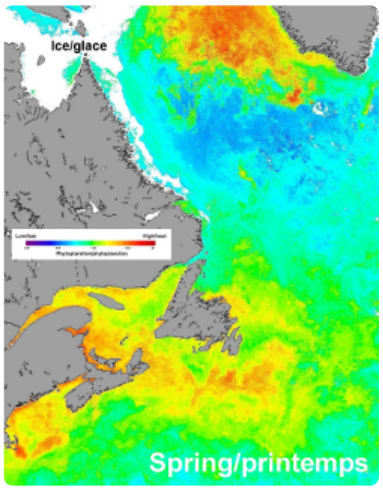
For bacteria and plankton distributions observed in recent years, see Recent Oceanographic Conditions in the Labrador Sea.

Information on related Climate and Ecosystem Research can be found under:

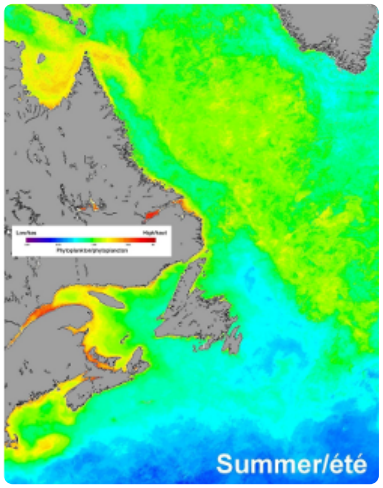
- Ecosystem Research



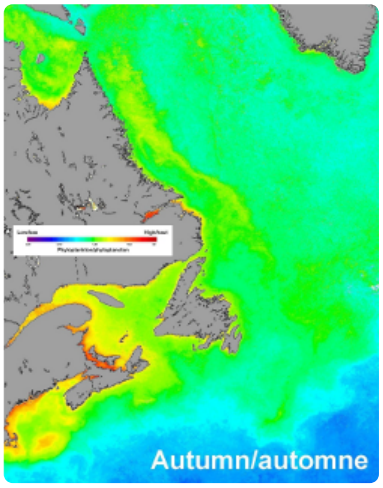
Winter



Spring



Summer



Autumn

▼ Recent Conditions

Recent Oceanographic Conditions in the Labrador Sea

Displays of the horizontal and vertical distribution of oceanographic variables in the Labrador Sea for individual years, available from 2006 onward, can be viewed or downloaded using the drop-down menus below. These displays are derived from observations taken during the annual AZOMP survey of the AR7W Line which has taken place in spring in recent years.

The variables are divided into four groups to facilitate the viewing:

- Physical: Potential Temperature (θ), Salinity (S), Potential Density (σ2, referenced to 2000m), and Dissolved Oxygen (DO)
- Carbon and Tracer: Total Alkalinity (TA), Total Inorganic Carbon (TIC), Chlorofluorocarbon-12 (CFC-12 and SF6)
- Nutrients: Nitrate, Phosphate, Silicate
- Zooplankton
- Plankton: Bacteria, Chlorophyll, Picoplankton, Nanoplankton

Separate panels for each variable and year are available. The year of interest can be selected from the drop-down menu, and the variable(s) by checking the appropriate box(es). Thumbnails of the cross-sea vertical section plots of the requested variables will be displayed, and a higher-quality plot can be obtained by clicking on the thumbnail of interest. The individual plots can be combined (by the user) to provide comparative displays across variables and years.

▼ Pelagic Bird Survey

Pelagic Bird Survey

The Canadian Wildlife Service of Environment Canada carries out a survey of pelagic birds during the annual oceanographic survey on the AR7W line across the Labrador Sea.

The goal of this survey is to gather data on the offshore distribution and abundance of marine birds in order to identify and minimize the impacts of human activities at sea on birds. These data will provide critical, and currently unavailable, information for environmental assessments for offshore developments, and will help identify areas where birds are at high risk from oil pollution, and other human activities.

Date modified:

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