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Conclusions Drawn from the Climatic Issues as Presented During the STACFEN Meeting in June 1996

by

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North Atlantic Oscillation

The North Atlantic Oscillation (NAO) index which represents the sea level pressure difference between Iceland and the Azores (Fig. 1) can be used as an indicator of the strength of northwestern winds over the Labrador/Greenland region. STACFEN recognizes that the NAO index explains largely the hemispheric conditions in the North Atlantic Ocean. As presented in a Russian study on the relationship between atmospheric, sea ice and oceanic variability in the Labrador Sea area and in the Barents Sea, high negative correlations between two widely separated regions for several variables including air temperature, ice coverage, and water temperature are shown. It was noted that while recent cooling has occurred in the Labrador Sea region, in the Barents Sea conditions have been very mild. The cause of the negative relationship is suggested to be related to the large-scale atmospheric wind patterns, i.e. the North Atlantic Oscillation (NAO). When the NAO index is high (Fig. 1), the Icelandic Low strengthens and the northwest winds over the Labrador Sea intensify, carrying cold air farther south. This produces more ice and colder ocean temperatures. At the same time over northern Europe the southwest winds intensify carrying warm air masses farther north causing warm conditions to develop in the Barents Sea. This leads to less ice and warmer ocean temperatures. The contrast between the high cod abundance in the warm Barents Sea with the low abundance in the cold Labrador Sea during recent years was highlighted. In 1995 the NAO index was strongly positive pointing at strong northwesterly winds over the Labrador Sea area. An eastward shift in the Icelandic Low and Bermuda-Azores High, however, resulted in their exerting less influence in the Northwest Atlantic than in other high NAO index years. There is, however, no indication for significant changes in the trend of the index curve (Fig. 1).

Greenland and Labrador Sea

As a consequence of the large positive NAO index - the positive trend is maintained since the end of the 1980s - extremely cold air temperatures were observed in winter off West Greenland, conditions which are similar to the winters of the early 1990s when record low temperatures were observed (Fig. 2). Above normal air temperatures began in April, persisted through most of the summer and reached a maximum in November. It was emphasized that, although 1995 showed relative warming compared to recent years, this does not yet signify a change in the longer-term negative trend in air temperatures that has persisted over the last 30 years. Ice conditions were near normal off East Greenland and along the Labrador Sea during the first few months of 1995 although coverage was more extensive than normal in the northeastern Labrador Sea area in the early spring. During the autumn of 1995, ice extent off East Greenland and Baffin Island were near normal. Colder-than-normal

ocean temperatures were observed in the upper 200m off Southwest Greenland whereas in the Irminger layer (200-300m) temperatures appeared to have declined slightly while salinities have increased.
Based on previous studies which showed a negative relation between cod recruitment off West Greenland and salinity of the Irminger water layer during the previous autumn, the high salinities would suggest the likelihood of poor cod recruitment.
Variability in near-bottom temperatures collected during German groundfish surveys off West Greenland from 1982-1995 were compared to changes in demersal fish assemblages and distribution. Correlation analyses failed to find a relationship between cod distribution and temperature, but it was shown that temperature does appear to influence growth rates and size of fish.

Labrador and Newfoundland
Moderate air temperatures during the late fall of 1995 and the winter of 1995/1996 resulted in below normal ice cover extent and concentration off the east coast of Labrador and Newfoundland. The warming trend that began during the fall of 1995 at Station 27 east off Newfoundland, continued into the winter and spring of 1996. This represents the first time in almost a decade that the near bottom temperatures were above their long-term mean. Temperatures throughout much of the water column over the Grand Bank and along eastern Newfoundland were also above normal. The temperature increase is attributed, in part, to reduced ice cover, i.e. the heat that in recent years was being used to melt ice, in 1995 went into heating the water column. There was less cold intermediate layer (CIL) waters over the shelf and core temperatures had increased. Meteorological, sea ice and oceanographic data during early 1996 all point to moderating conditions relative to the cold conditions of the early 1990s.

Middle Atlantic Bight and Gulf of Maine

Monthly monitoring of surface and bottom temperatures on a transects across the Middle Atlantic Bight and the Gulf of Maine showed generally warmer-than-normal conditions during 1995, with an annual anomaly of upwards of 1.6K near-bottom over the shelf portion of the Middle Atlantic Bight. Surface salinities were above average for the year in the Middle Atlantic Bight.

Overview on Environmental Conditions during 1995
The presentation of the annual overview paper based on several long-term oceanographic and meteorological data sets, as well as from available research documents revealed that cold winter air temperatures were again observed in the Labrador Sea region but they were generally not as low as in previous years (Fig. 3). It should be noted that for the northern sites given in Fig. 3 at Godthaab/Nuuk, Iqaluit (Baffin Island) and Cartwright (Labrador) mean annual air temperatures still indicate a significant negative trend. At the southern boundary of NAFO Convention Area, air temperatures were generally warmer than normal throughout the year, except for November and December when temperatures dropped below normal.
The volume extent of the CIL water off Newfoundland during the summer decreased in 1995 to below the long-term mean and is at its lowest value since the early 1980s. This was due to a decline in the amount of CIL water off southern Labrador and northern Newfoundland (Fig. 4), in contrast to the Grand Bank where the amount of CIL water increased slightly relative to 1994.
Deep water temperatures on the Scotian Shelf (Emerald Basin) and in the Gulf of Maine remained high during 1995 while in Cabot Strait they

decreased to near normal values. The high temperatures on the Scotian Shelf and in the Gulf of Maine are believed to be due to the influence of warm slope waters penetrating into the deep basins.
Cold waters were observed near-bottom and at intermediate waters over the northeastern Scotian Shelf and off southwestern Nova Scotia continuing a trend that began in the mid- to late-1980s. In the latter region, temperatures appear to be warming although they remain below normal. No evidence of warming was observed in the northeastern Scotian Shelf.

References

Drinkwater, K.F., E. Colbourne, and D. Gilbert. 1996. Overview of Environmental Conditions in the Northwest Atlantic in 1995. NAFO SCR. Doc. 96, No. 41, Serial No. N2716, 65p.

Stein, M. 1996. Climatic Conditions Around Greenland - 1995. NAFO SCR. Doc. 96, No.15, Serial No. N2688, 15p.

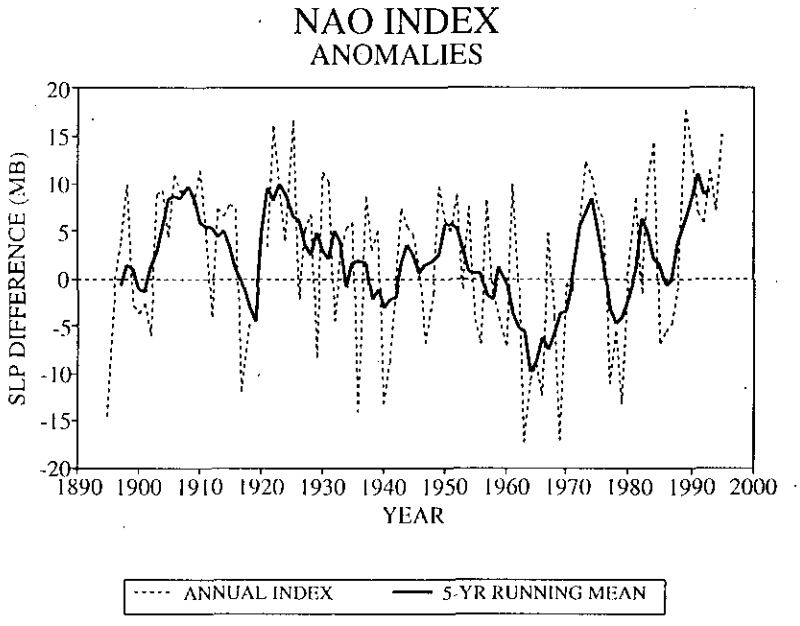

Fig. 1 The North Atlantic Oscillation Index defined as the winter sea level pressure difference (Azores - Iceland) From: Drinkwater et al. (1996).

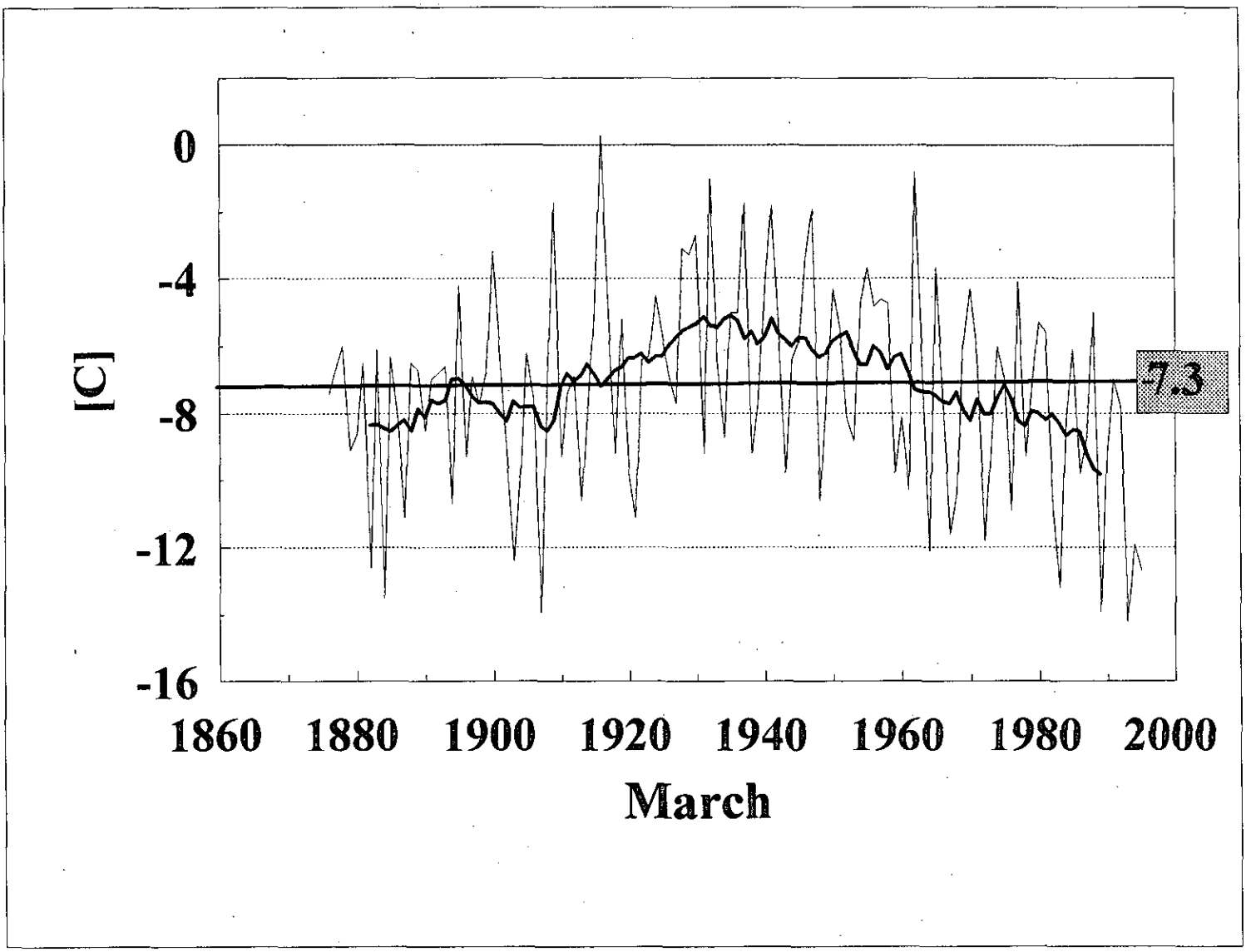

Fig. 2 Air temperatures at Nuuk/West Greenland for March (long-term trend and mean are given). From: Stein (1996).

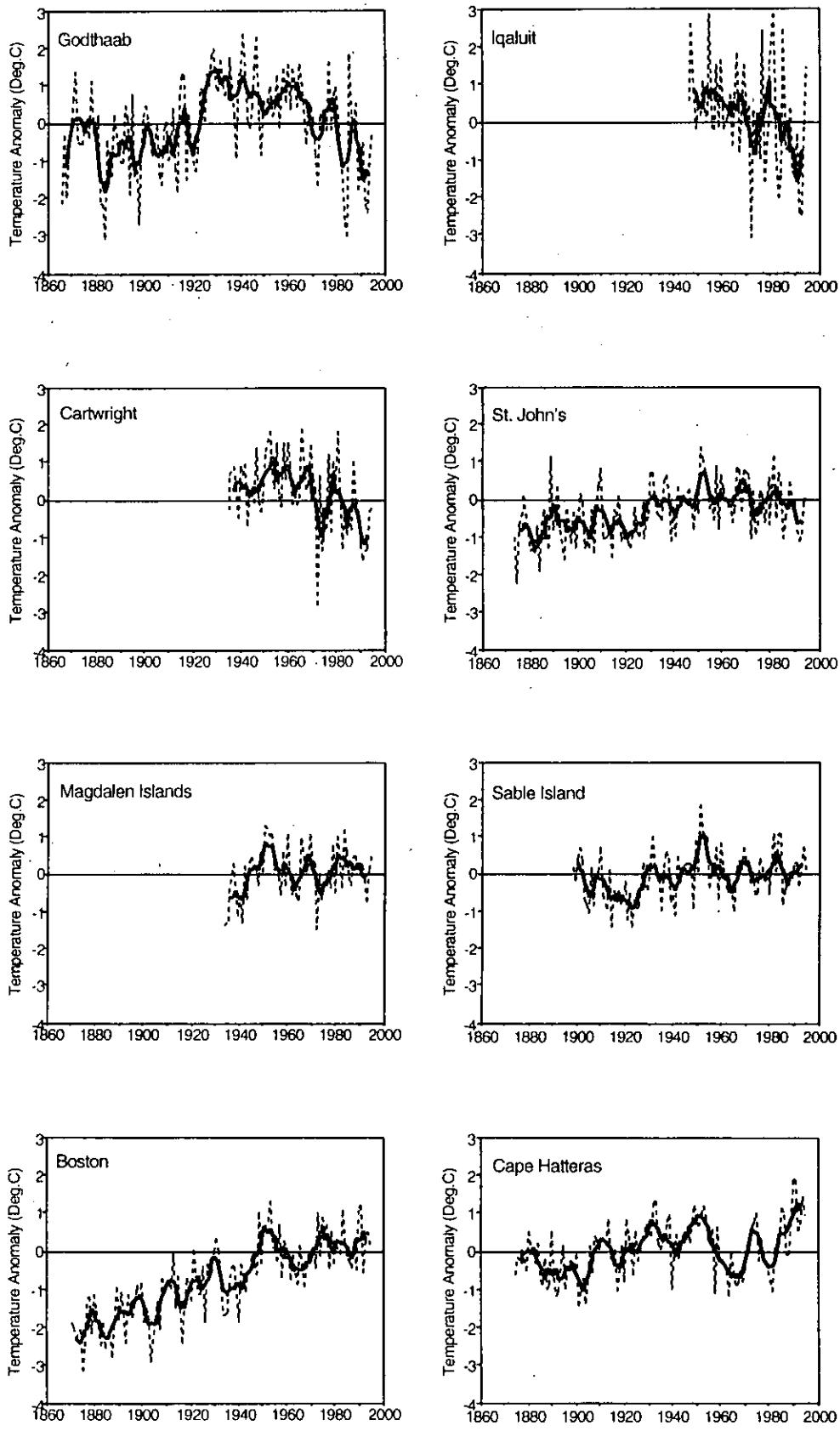

Fig. 3 Annual and 5-year running means of the air temperature anomalies at selected sites. From: Drinkwater et al. (1996).

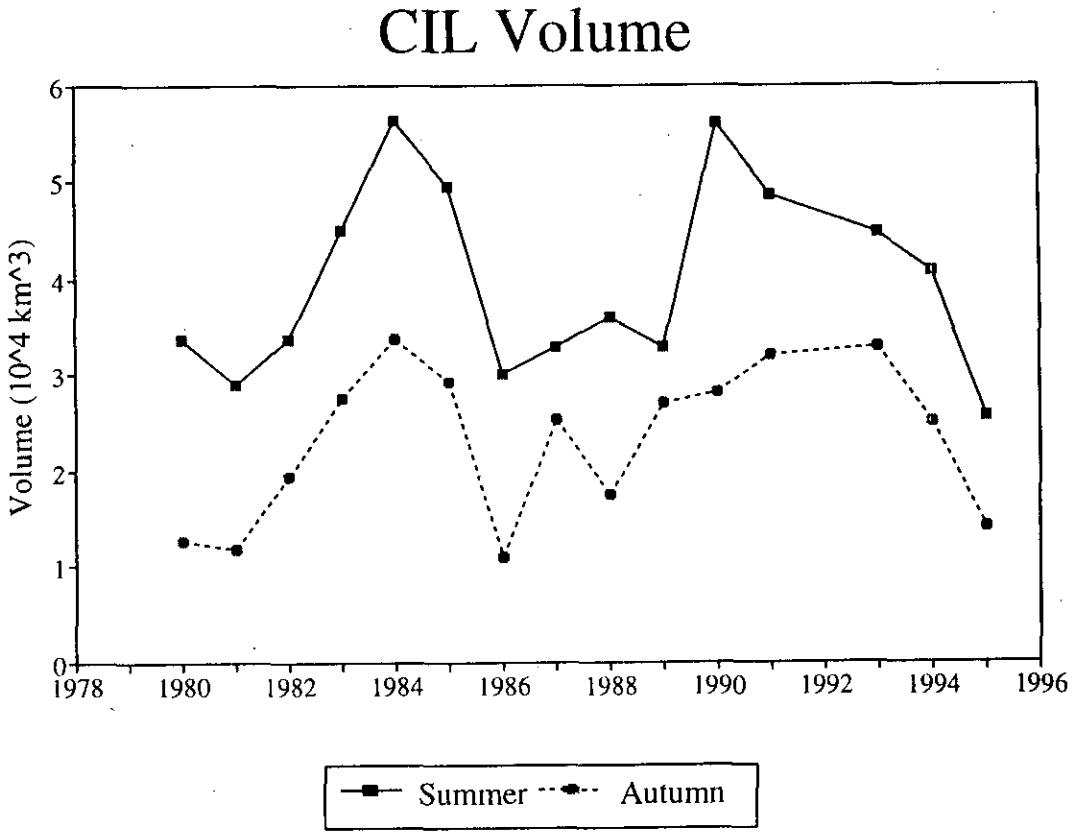

Fig. 4 Time series of the CIL volumes within Subareas 2J3KL. From: Drinkwater et al. (1996).