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Oceanographic Investigations off West Greenland, 1997

by

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1. Introduction

Climate variability do have a strong impact on the living conditions for a number of fish stocks living close to the limit of their existence in the West Greenland area. It is therefore of great importance in the field of fisheries assessment to have a general knowledge of the interannual changes in climate and more importantly a detailed knowledge of the ocean climate variability. The Greenland Natural Institute (former Greenland Fisheries Research Institute) have traditionally at least once a year performed oceanographic observations on the NAFO standard sections along the West Greenland fishing banks. Since 1992 the Oceanographic Department of the Royal Danish Administration of Navigation and Hydrography has - on a contract with the Greenland Natural Institute - been responsible for one annual cruise and the subsequent data handling. The present report deals with the observations performed in 1997.

2. Measurements

The 1997 cruise was carried out during the period June 23 - July 10 onboard the Danish naval ship **"TULUGAQ".** Observations was performed on the following stations:

Cape Farewell st. 1 - 5
Cape Desolation st. 1 - 5
Frederikshaab st. 1- 5
Fylla Bank st. 1- 5
Lille Hellefiske Bank st. 1 - 5
Holsteinsborg st. 1 - 5

On each stations the vertical distributions of temperature and salinity was measured from surface to bottom, except on stations with depths greater than 1000 m where 1000 m was the maximum depth of observation.

The cruise was blessed with favourable weather and ice conditions. "Vestice" was not present at the Holsteinsborg section and only at the innermost stations at the Cape Farewell section "Storis" was observed in minor quantities.

3. Data handling

Measurements of the vertical distibution of temperature and salinity was carried out using a SEABIRD SBE 9-01 CTD. For the purpose of calibration of the conductivity sensor of the CTD water samples were taken at great depth

on stations with depths greater than 500 m. The water samples were after the cruise analysed on a Guildline Portosal 8410 salinometer.

The CTD data were analysed using SEASOFT 4.217 software provided by SEABIRD.

All quality controlled data are stored in the Marine Database at the Royal Danish Administration of Navigation and Hydrography from where copies have been sent to ICES and MEDS together with the oceanographic collected by the Greenland Natural Institute in 1997 during their trawl surveys.

4. Oceanographic conditions off West Greenland in 1997

The climatic conditions in the West Greenland area has after the cold period 1989 - 1994 been relative mild in 1996 -1997 as can be seen in Fig. 1 showing the anomaly of the annual mean air temperature at NUUK for the period 1873 to 1997. The anomaly is taken relative to the mean temperature for the whole period.

As discussed by Buch, 1997 the air temperatures over Greenland are closely coupled to the strength of the North Atlantic Oscillation (NAO) which refers to a meridional oscillation in the atmospheric mass with centres of action near the Iceland Low and the Azores High (van Loon and Rogers, 1978). A high NAO index means cold conditions in the Greenland area, the relatively mild climate in Greenland during the recent two years may therefore be taken as a sign of a decrease of the extremely high NAO observed in the early 1990'ies.

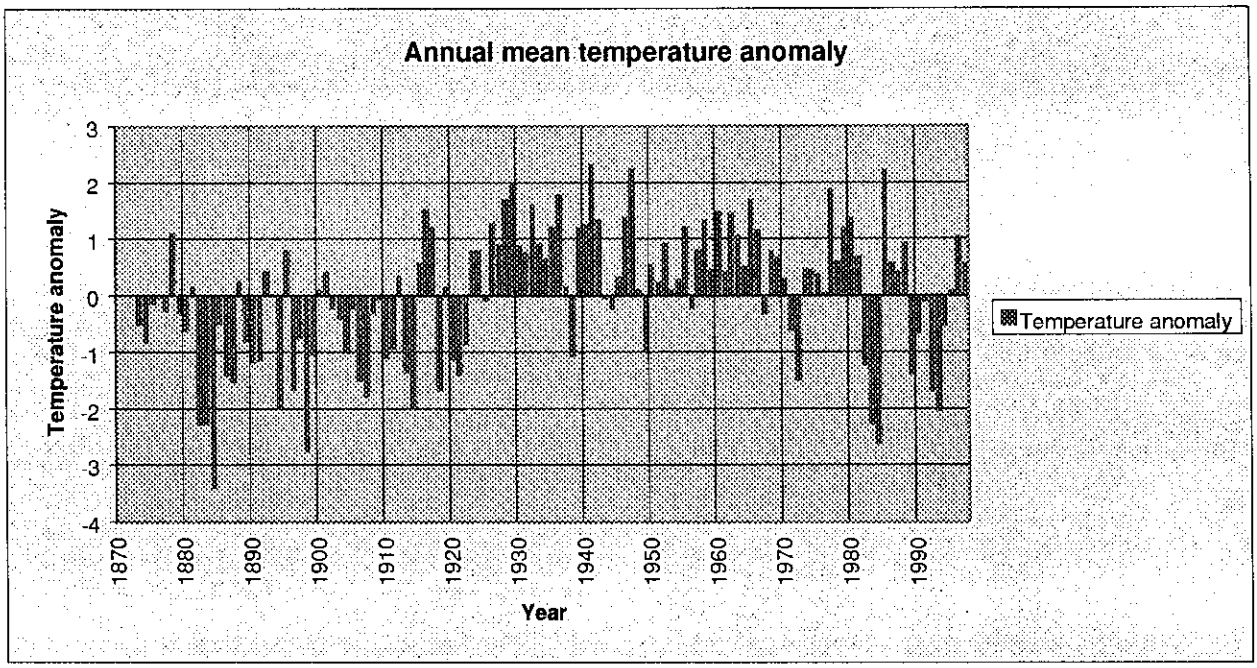
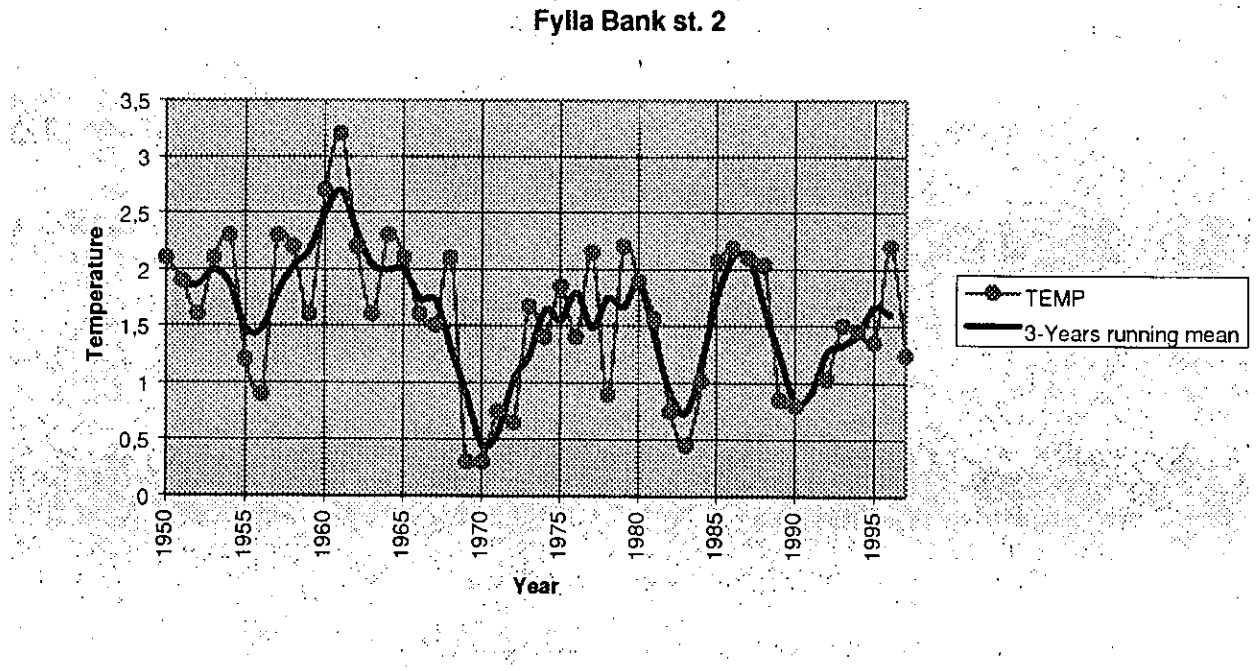


Fig. 1. *Anomaly in the annual mean air temperature observed at NUUK for the period 1873 to 1997. The anomaly is taken relative to the mean temperature for the whole period*

a)



b)

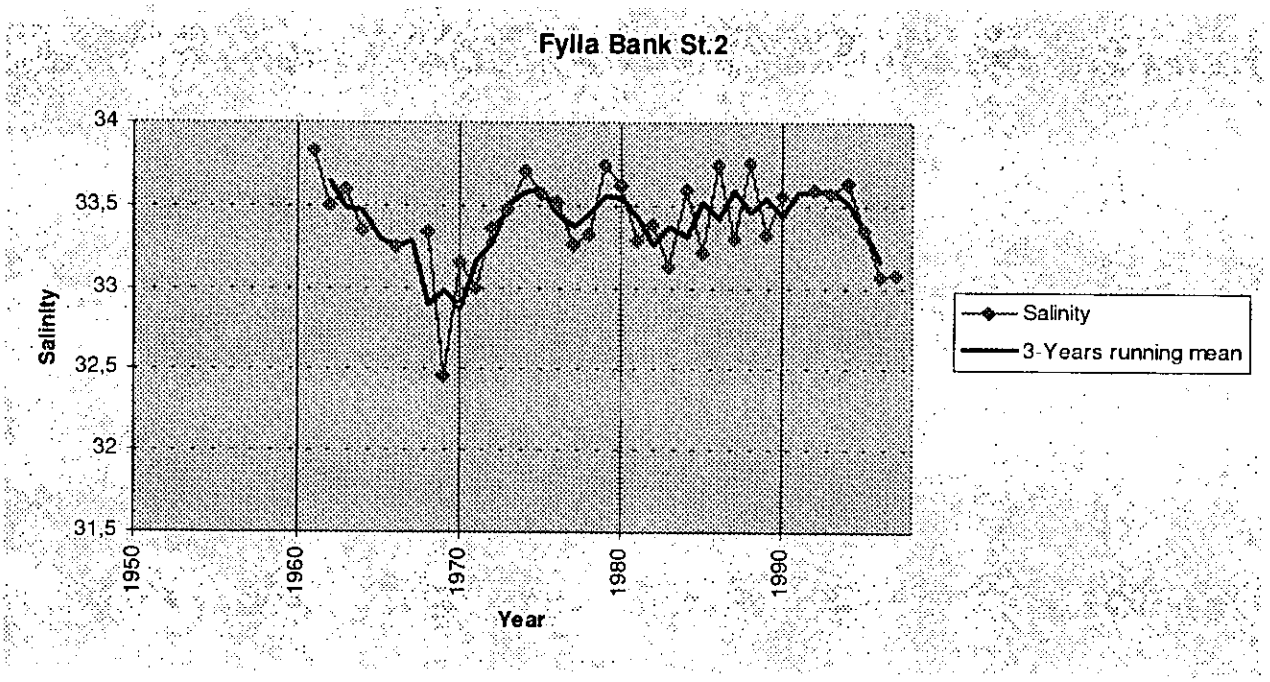


Fig. 2. *Timeseries of*

a) mean temperature (observations and 3 year running mean)

b) mean salinity (observations and 3 year running mean)

on top of Fylla Bank (0 - 40 m) in the middle of June

The mean temperature and salinity on top of Fylla Bank in the middle of June, Fig. 2, show that a remarkably low temperature was observed in 1997 although the atmospheric conditions were quite warm, Fig. 5 and 7, which could indicate a high inflow of Polar Water. Additionally relatively low salinity's were observed in 1996 and 1997 indicating that the inflow of Polar Water have been above normal in these years. This could be a sign of a new "Salinity Anomaly" although not yet of the same dimension as the one experienced around 1970. Analysis of data from the other Southwest Greenland sections show extremely low salinity values at the sections north of Fylla Bank (station 2 on the Lille Hellefiske Bank - and Holsteinsborg sections) in 1996, comparable to the low values observed in the late 1960'ies. At the southernmost sections - Cape Farewell to Frederikshaab - no real time series exists, but judged from the observations made in June-July since 1992 abnormally low salinity's were observed only at the Cape Farewell section in 1996.

It may therefore be concluded that a "low salinity signal" was observed in the Polar Water component off Southwest Greenland at most sections in 1996.

The surface temperatures and salinity's observed during the 1997 cruise are shown in Figs. 3 and 4. Water of Atlantic origin (T> 3°C; S> 34.5 psu) are found at surface only at the two outermost stations at the Cape Farewell section. Cold, low-saline water are found near the coast as far north as the Fylla Bank section, at the three southernmost sections the surface salinity are below 32 psu in vast area. Abnormal high surface temperatures - T > 6°C - were observed at the outermost stations at the Cape Desolation- and Cape Farewell sections.

The vertical distribution of temperature and salinity at the six observed sections is given in Figs. 5 - 10.

The surface layer is in 1997 only at the Cape Farewell Section highly dominated by strong gradients between the cold, low-saline Polar Water and the warm, high-saline water of Atlantic origin. Further north the gradient is rather weak and the surface layer is mainly dominated by Polar Water.

At greater depth it is notice that 1997 can be characterised as a year with a higher than normal inflow of pure Irminger Water (T ~ 4.5°C, S > 34.95 psu). A tongue of Irminger Water was observed as far north as beyond the Frederikshaab section, and even salinity values above 35.0 psu was at the Cape Farewell section. The core of the inflowing Irminger Water was found relatively close to the continental rise at a depth of around 150 m at the Cape Farewell - and Cape Desolation sections while at the Frederikshaab section is was found further off shore and at 300 meters depth.

Modified Irminger Water (34.88 < S < 34.95) was not observed north of the Fredrikshaab section, but was present in great quantities at the three southernmost sections.

Sub-Atlantic water (3.5 < T < 4.5; 34.5 < S < 34.88) was observed at all six sections in 1997.

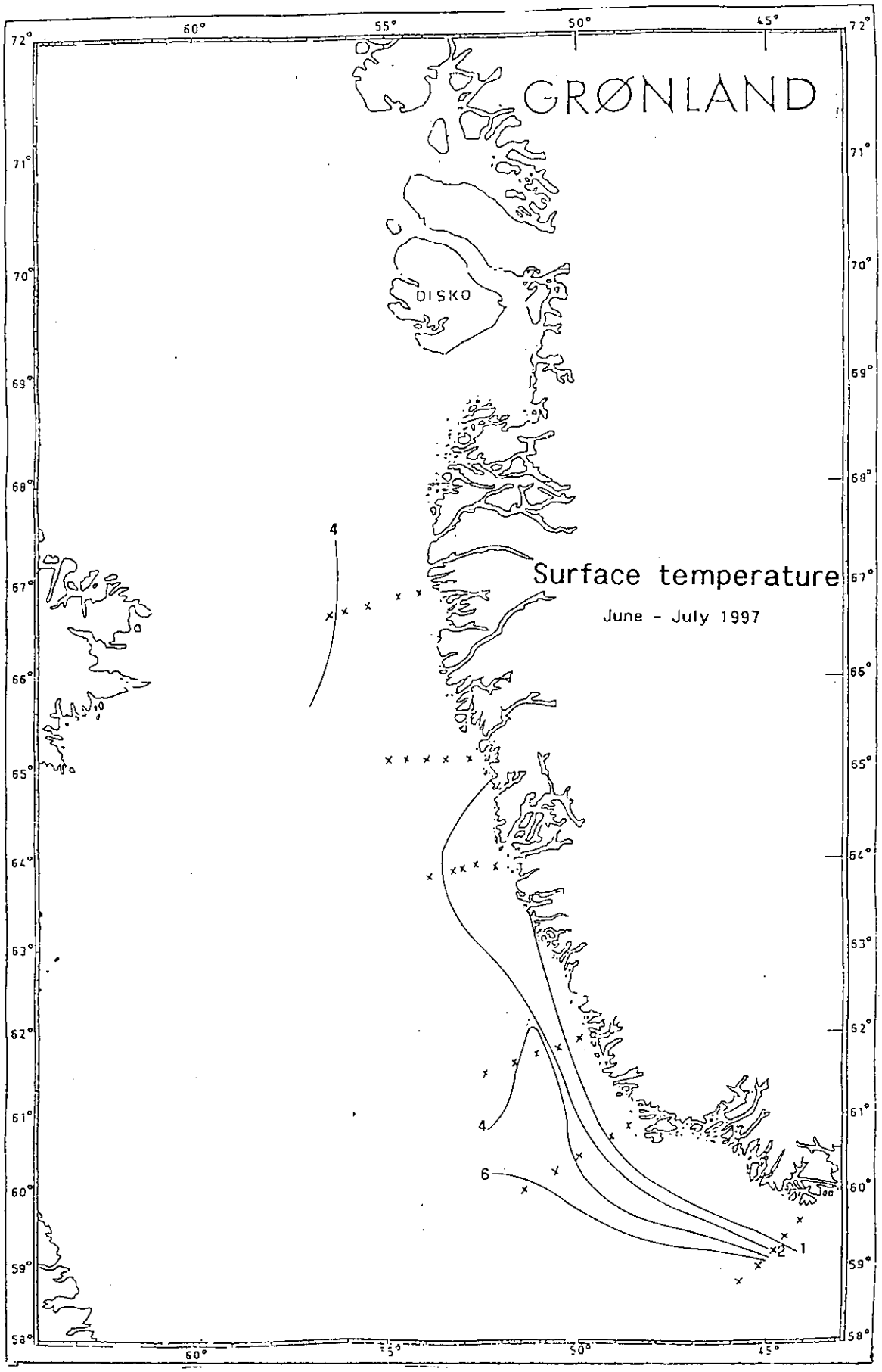


Fig. 3. *Surface temperatures, June - July 1997.*

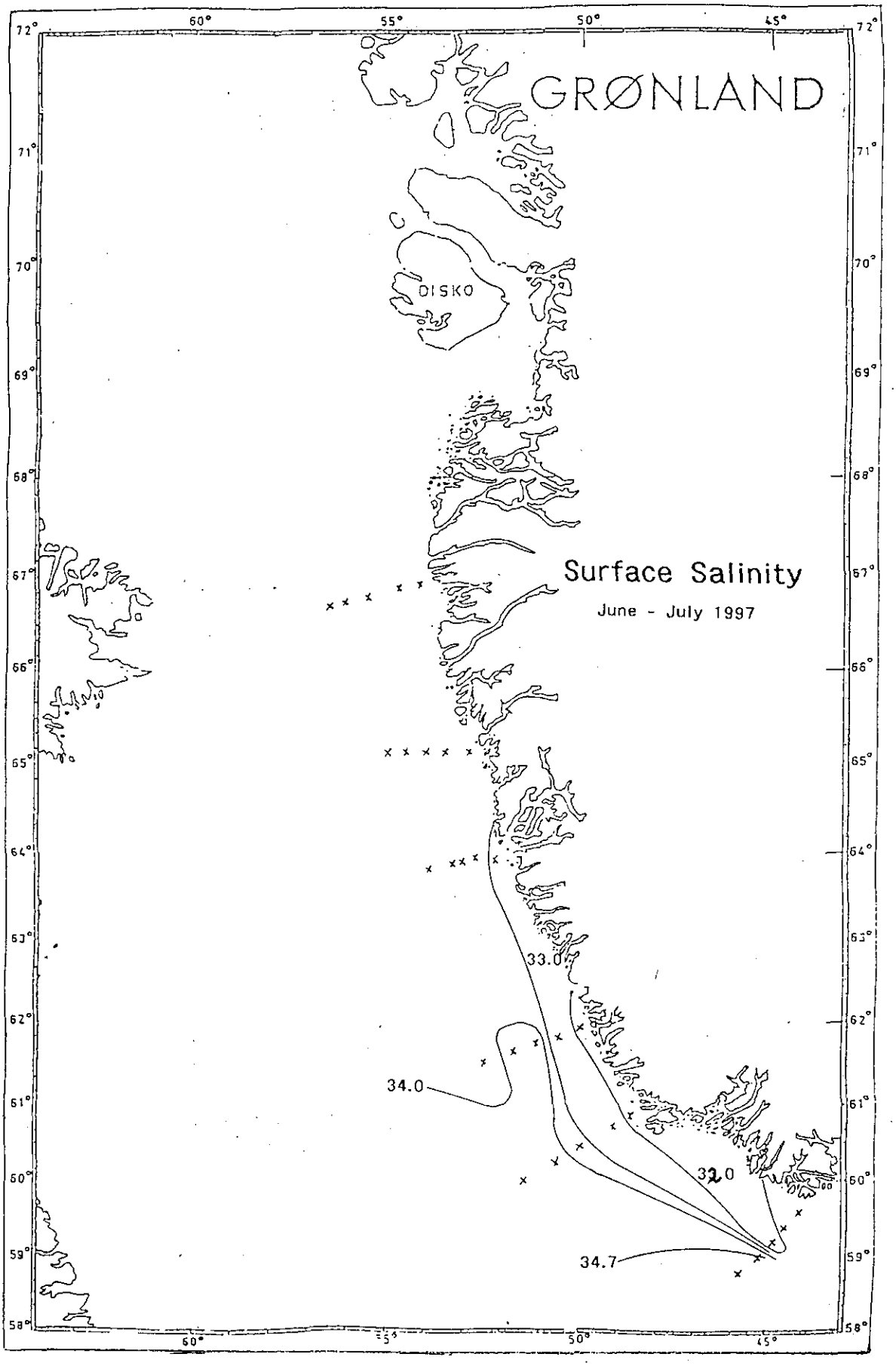


Fig. 4. *Surface salinity's, June July 1997*

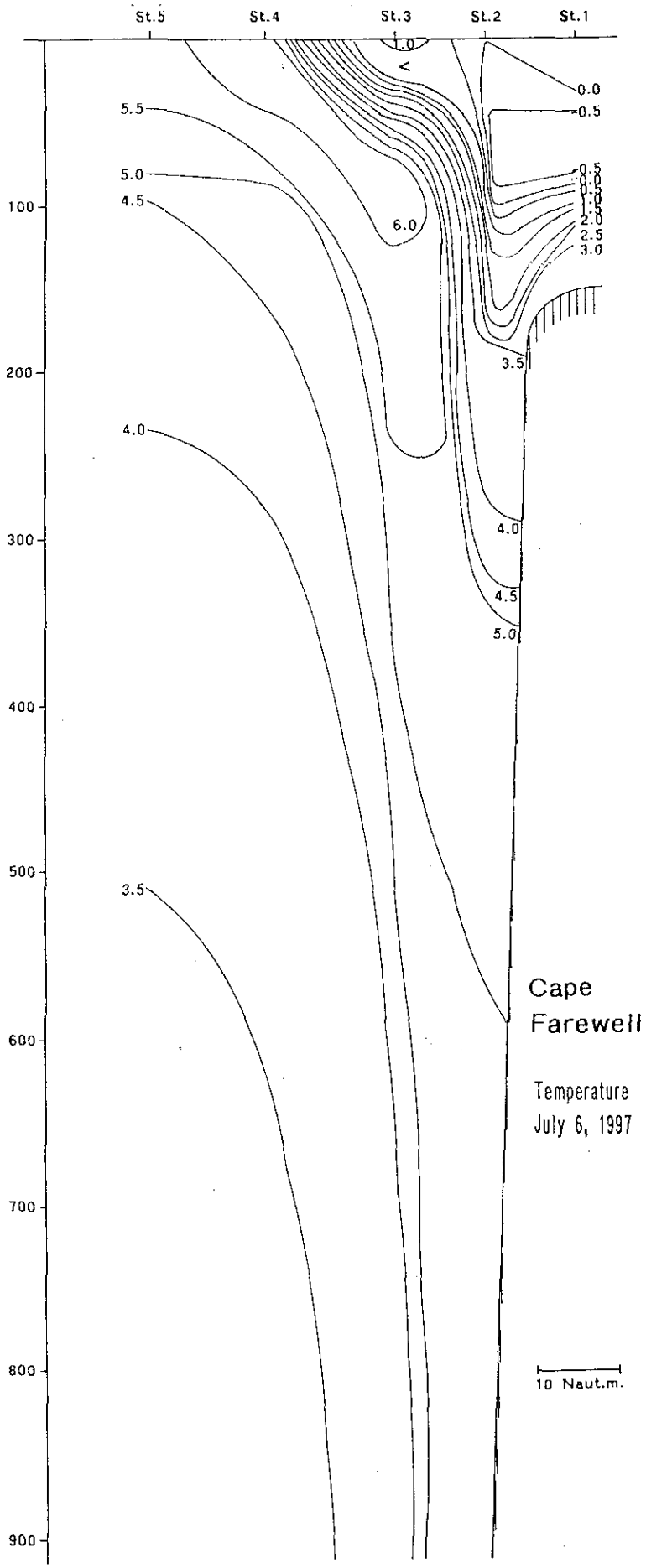


Fig. 5a. *Vertical distribution of temperature at the Cape Farewell section, July 6 1997*

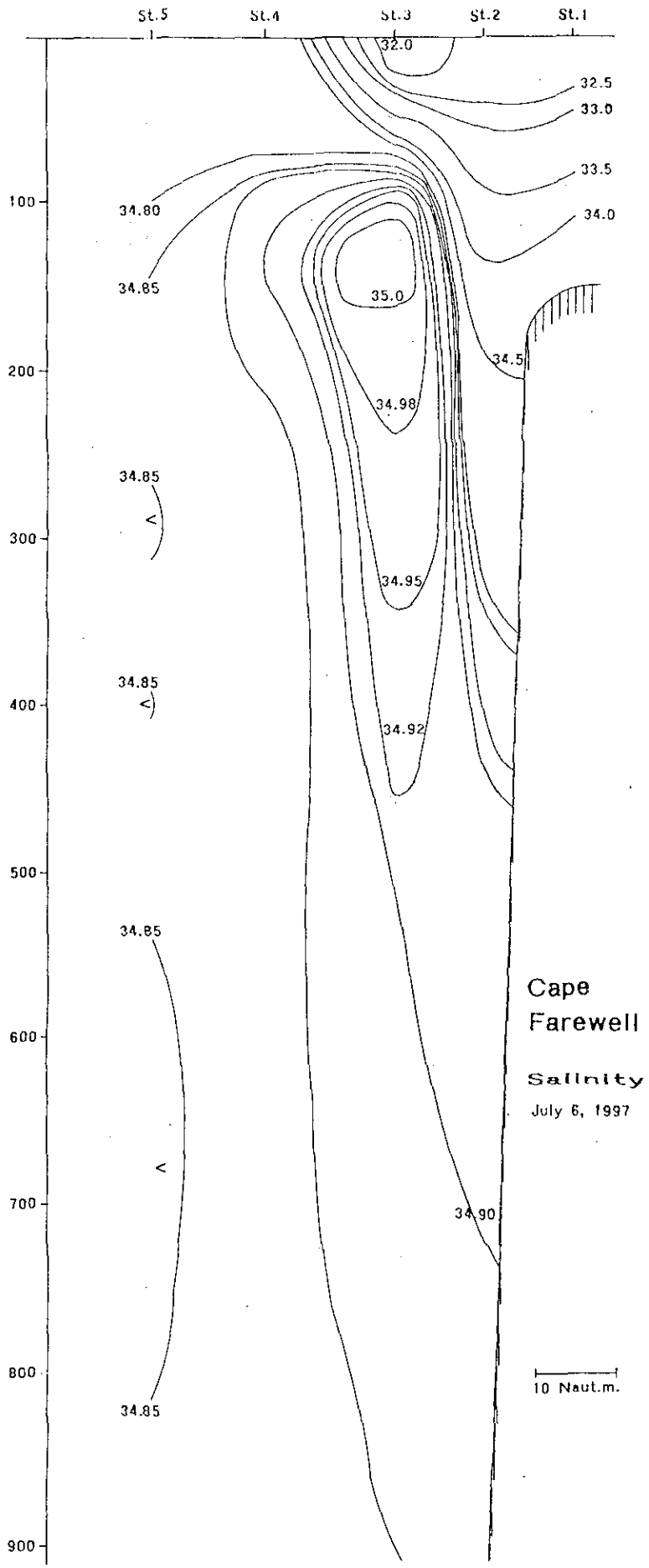


Fig. 5b. *Vertical distribution of salinity at the Cape Farewell Section, July 6 1997.*

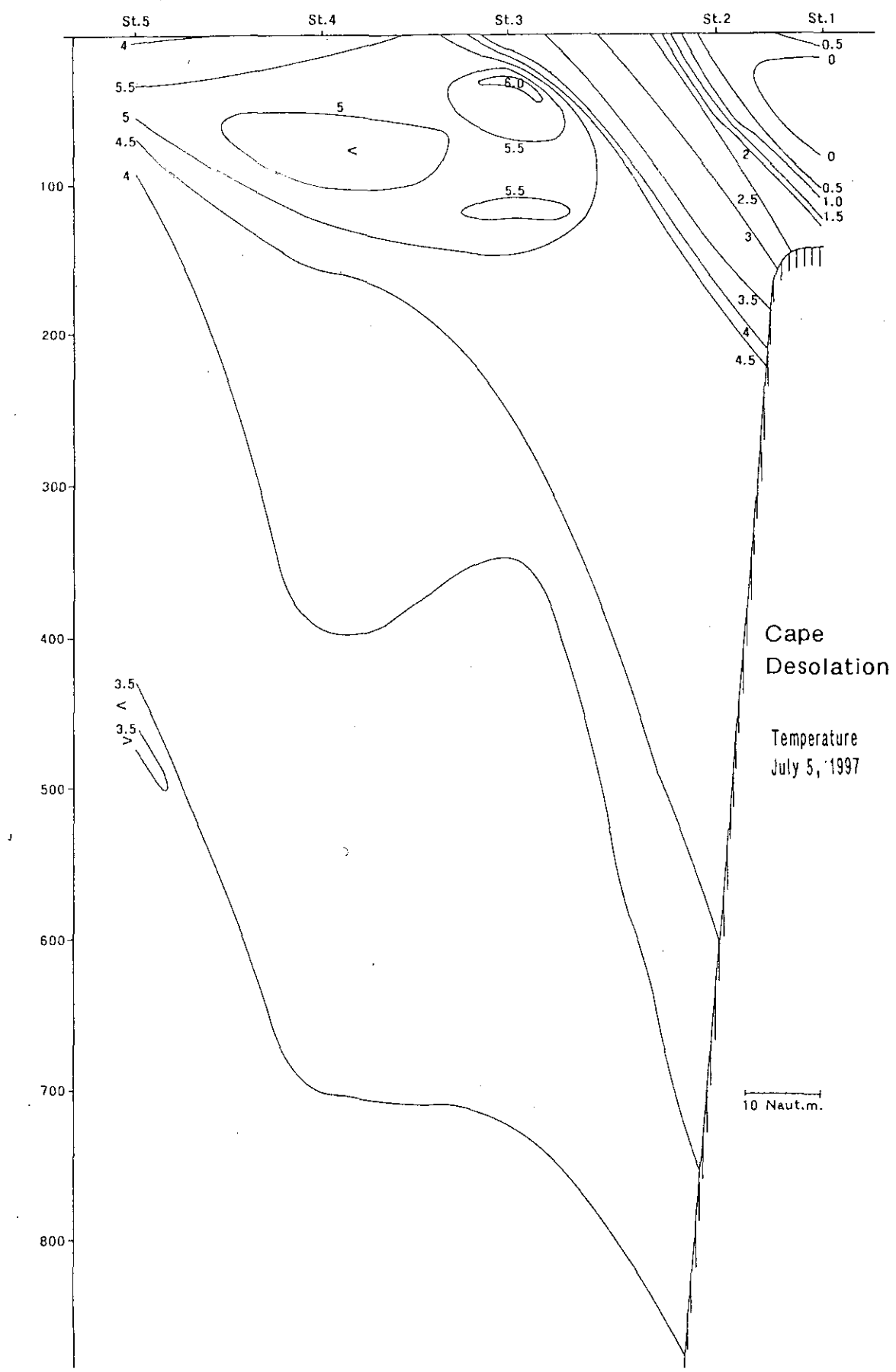


Fig. 6a. *Vertical distribution of temperature at the Cape Desolation Section, July 5 1997.*

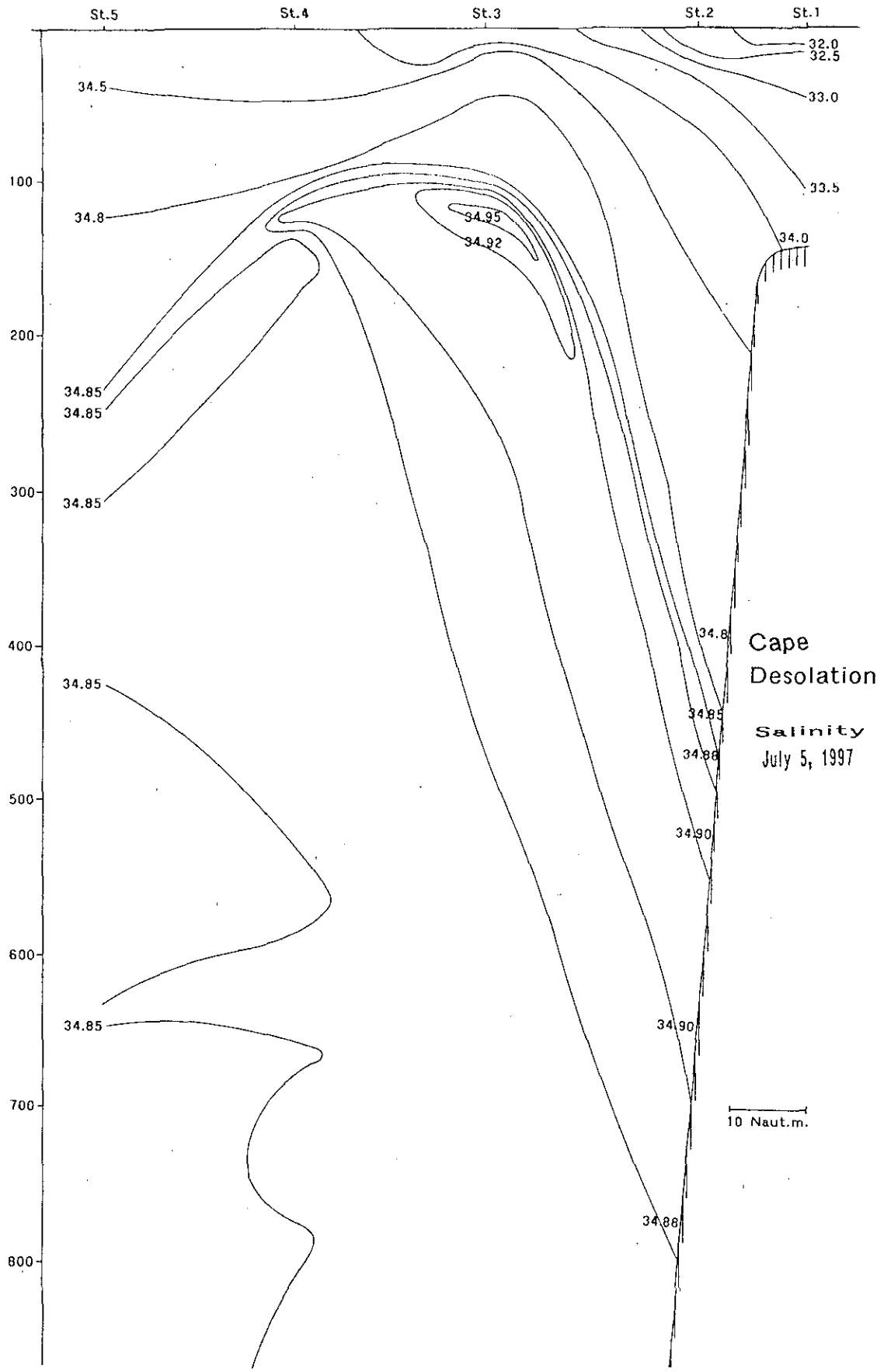


Fig. 6b. *Vertical distribution of salinity at the Cape Desolation Section, July 5 1997.*

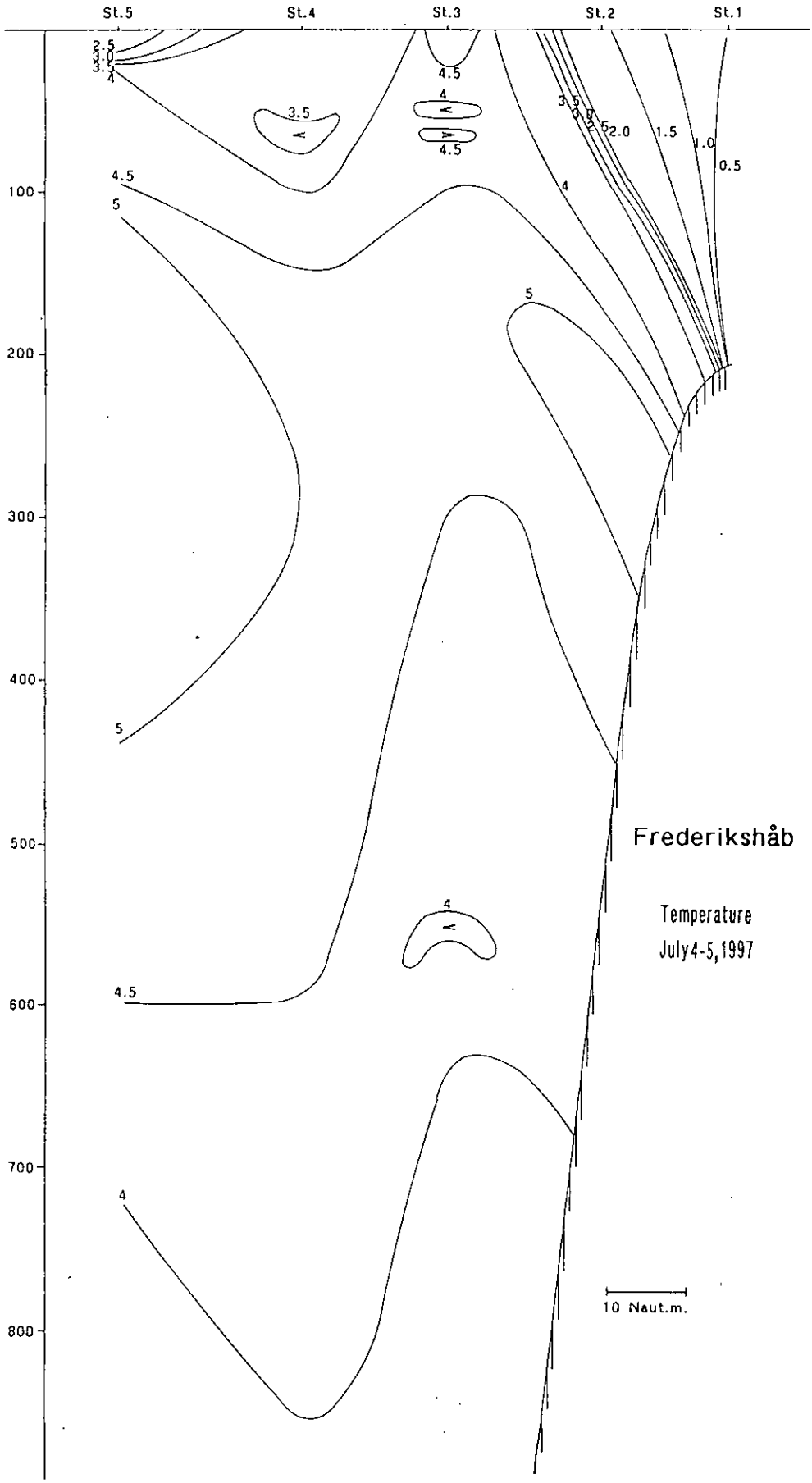


Fig. 7a. *Vertical distribution of temperature at the Frederikshaab Section, July 4-5 1997.*

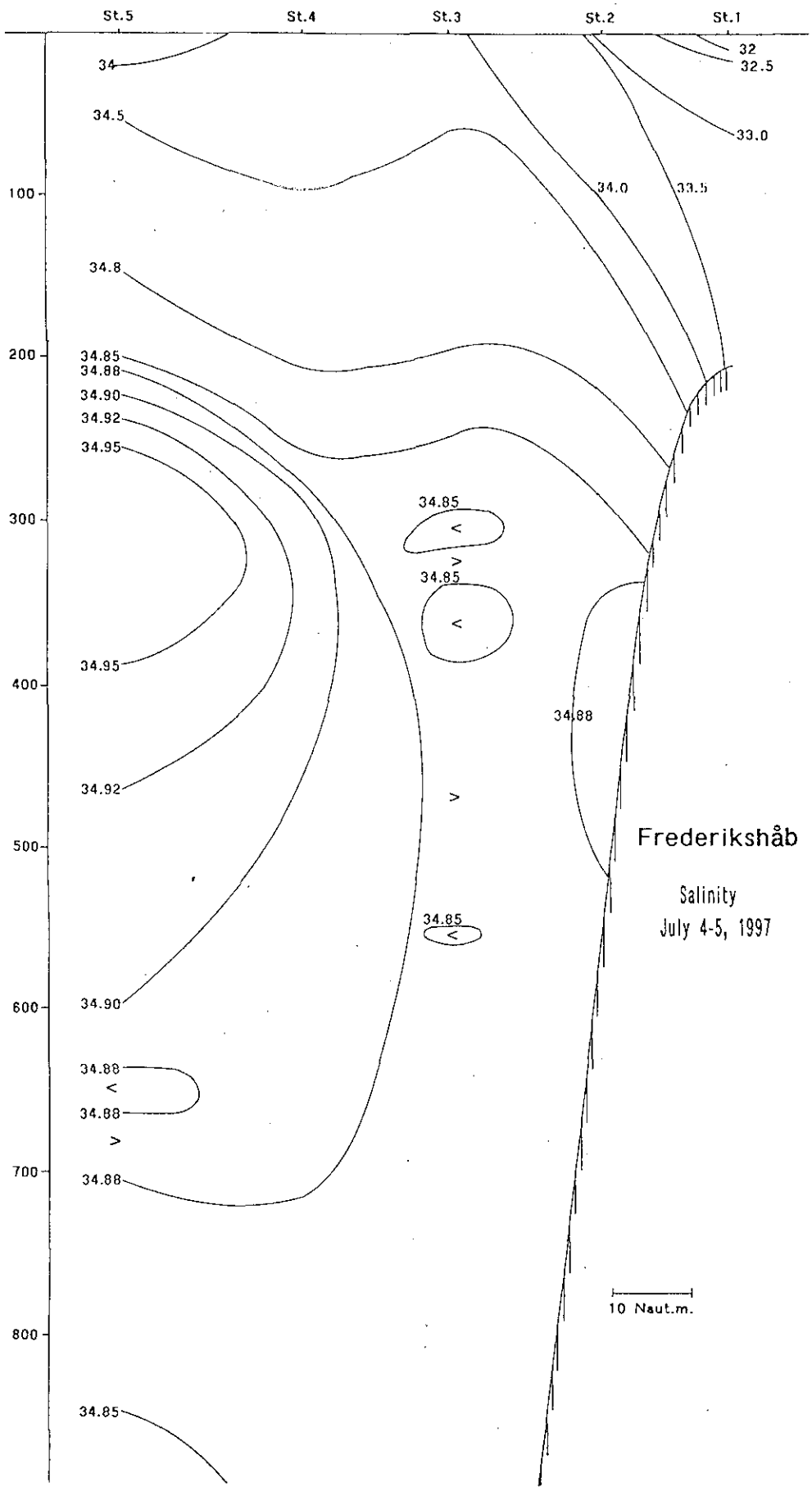


Fig. 7b. *Vertical distribution of salinity at the Frederikshaab Section, July 4-5 1997.*

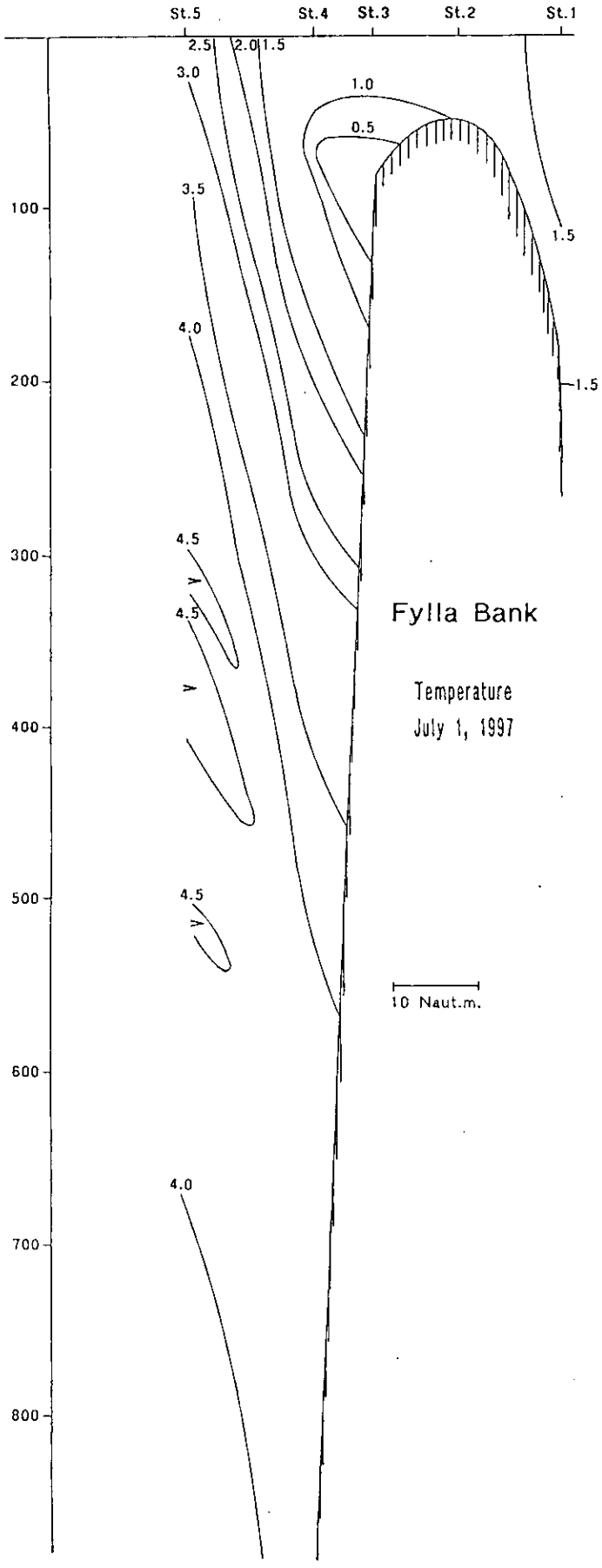


Fig. 8a. *Vertical distribution of temperature at the Fylla Bank Section, July 1 1997.*

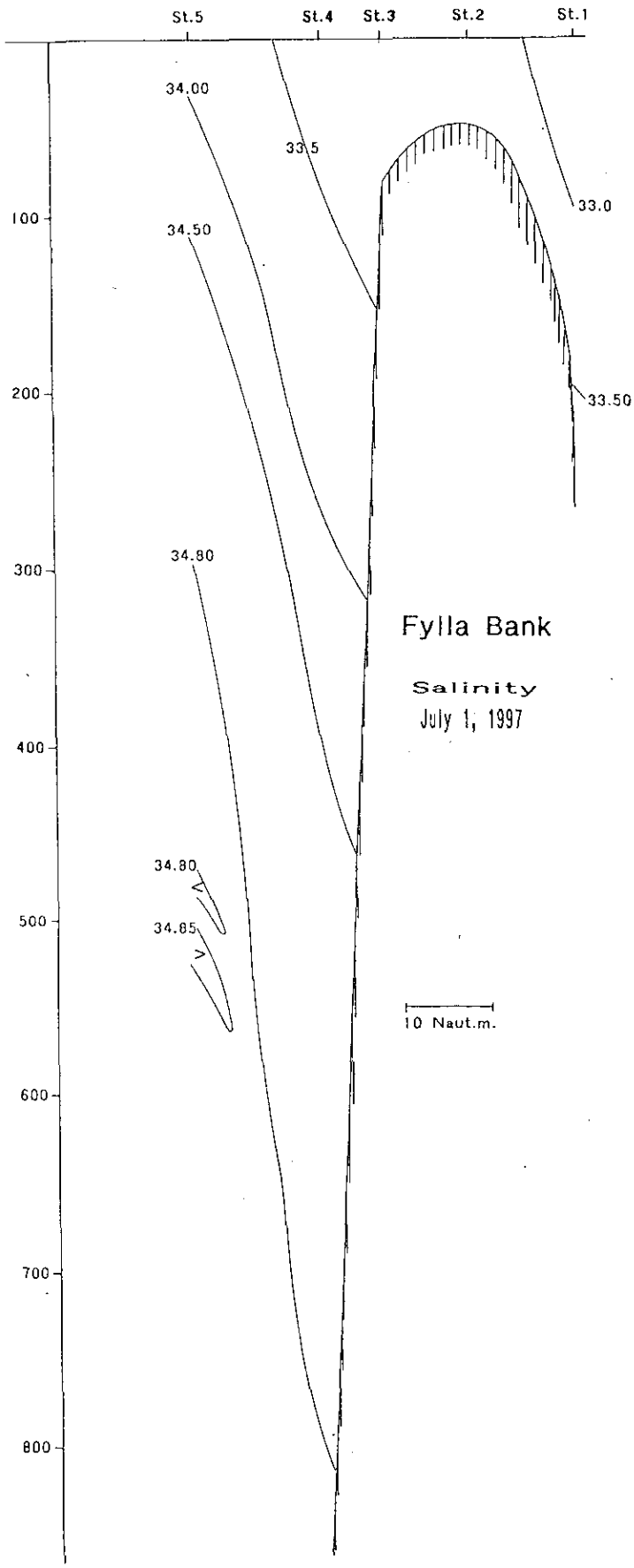


Fig. 8b. *Vertical distribution of salinity at the Fylla Bank Section, July 1 1997.*

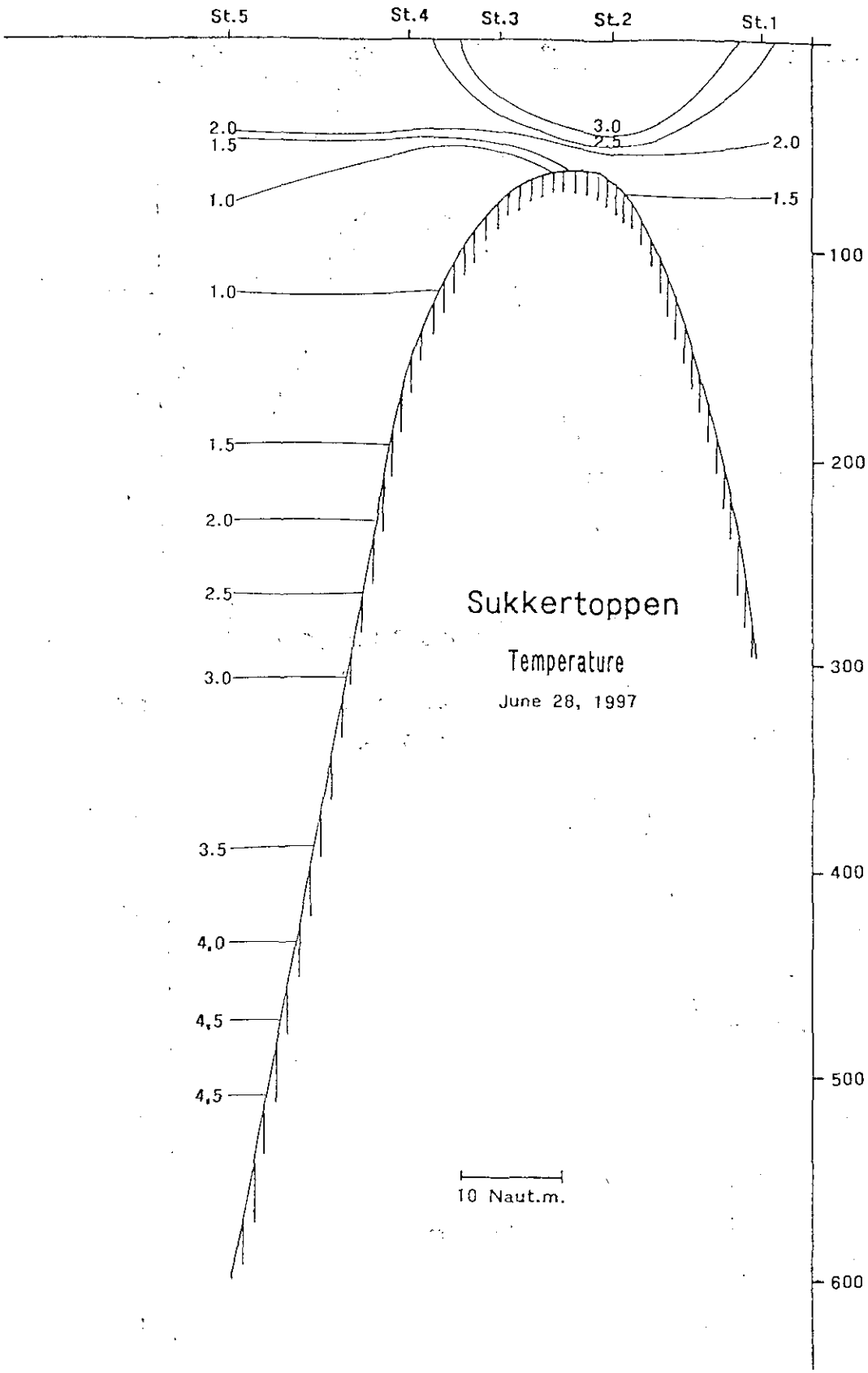


Fig. 9a. *Vertical distribution of temperature at the Lille Hellefiske Bank Section, June 28 1997.*

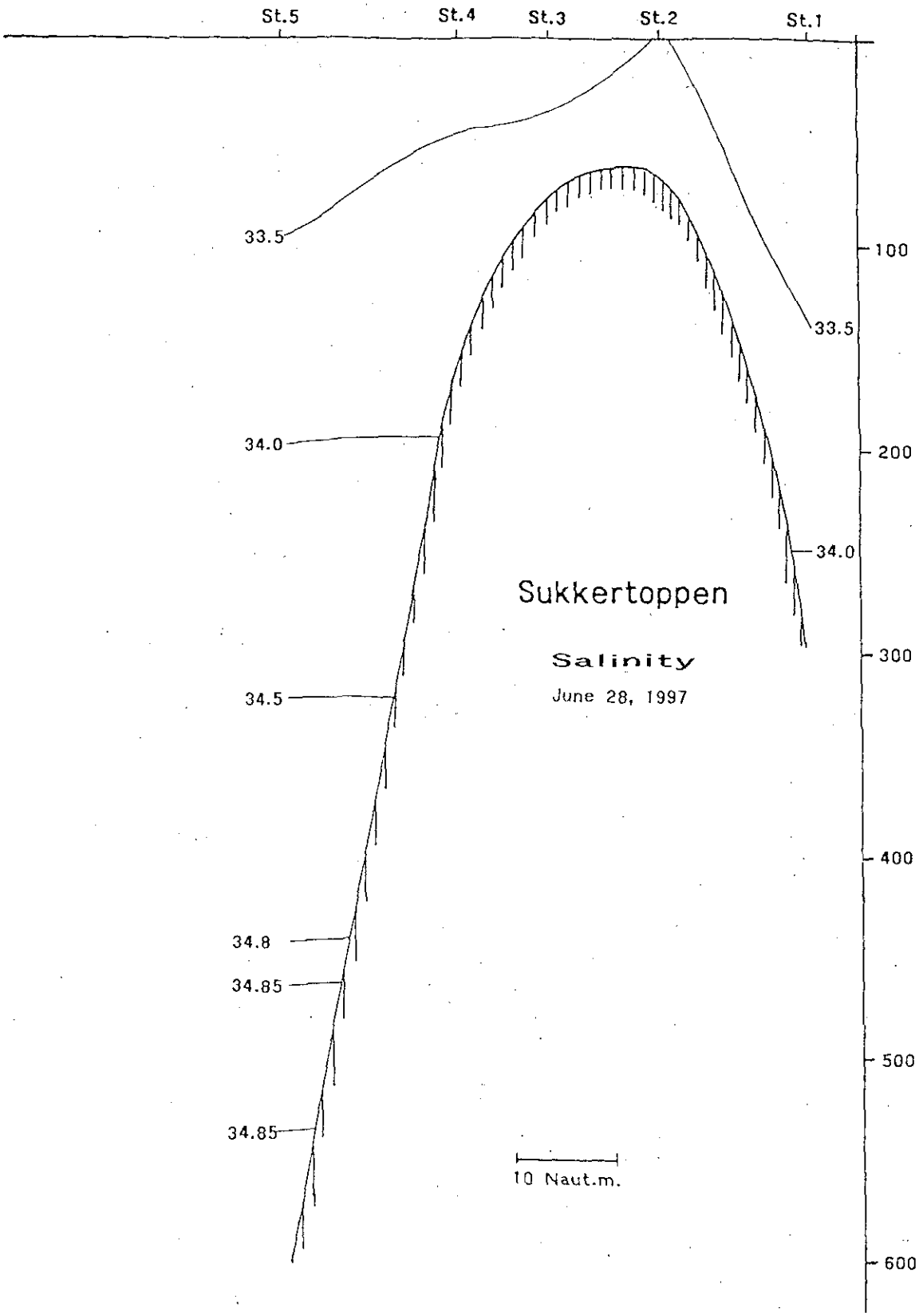


Fig. 9b. *Vertical distribution of salinity at the Lille Hellefiske Bank Section, June 28 1997.*

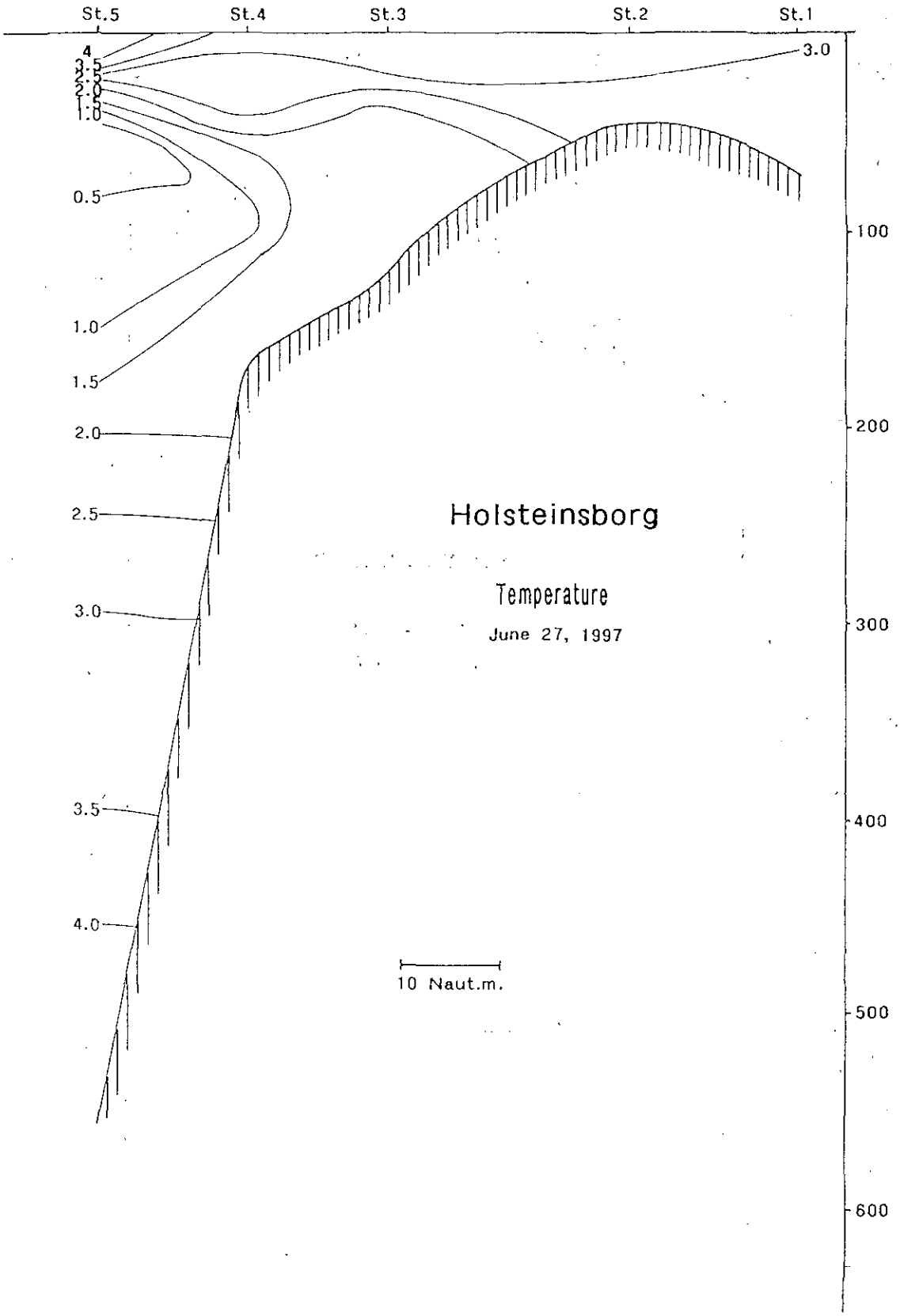


Fig. 10a. *Vertical distribution of temperature at the Holsteinsborg Section, June 27 1997.*

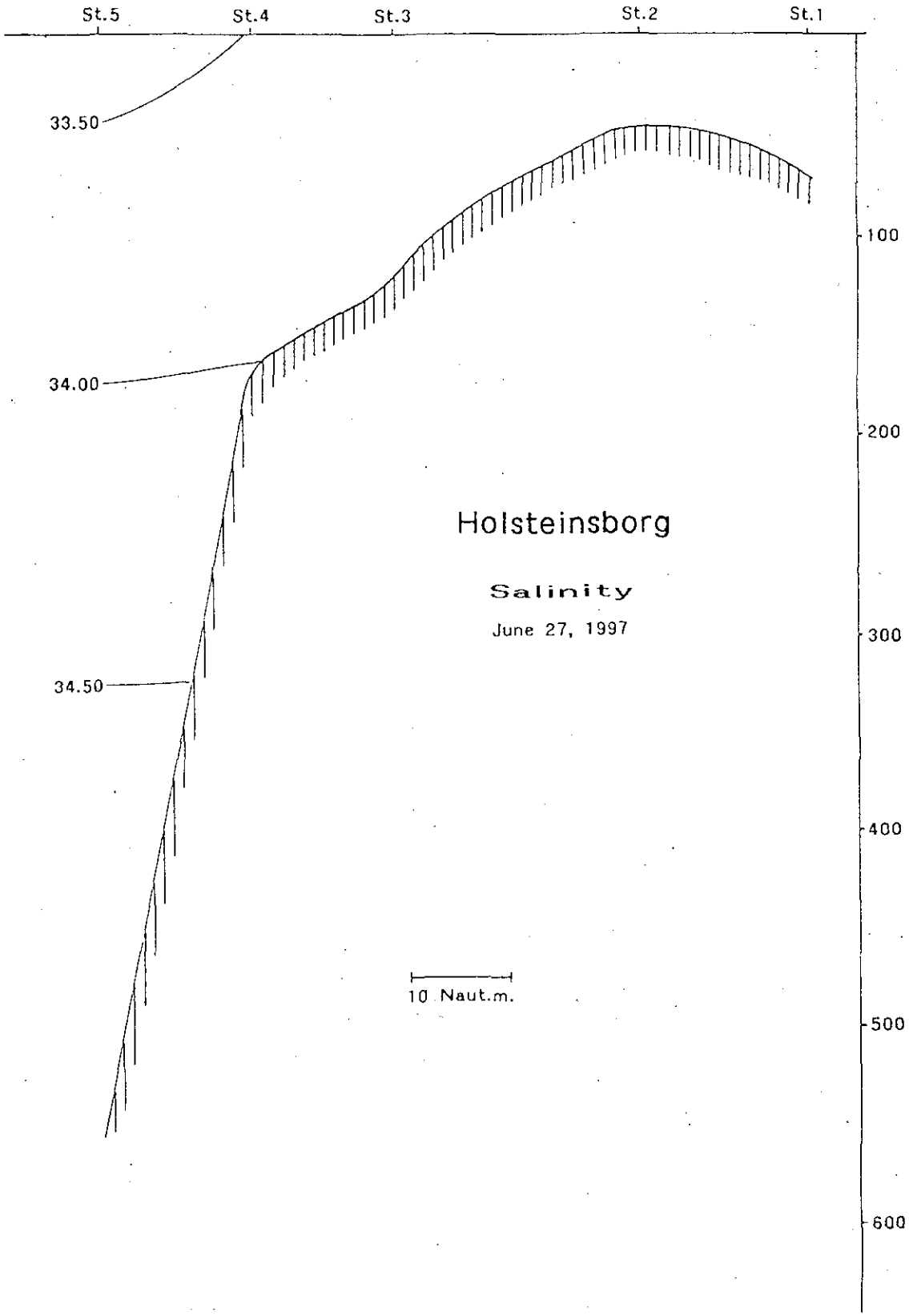


Fig. 10b. *Vertical distribution of salinity at the Holsteinsborg Section, June 27 1997.*