



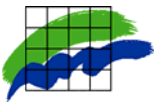
r/v Gunnar Thorson

Monitoring Cruise Report

Cruise no.: GT 252
Time: 25 - 29 January 2010
Area: The Sound, the Arkona Sea,
the Belt Sea and the Kattegat



National Environmental Research Institute
Aarhus University
Frederiksborgvej 399
DK-4000 Roskilde
Denmark
Tel.: +45 4630 1200 • Fax: +45 4630 1114
www.neri.dk



Data sheet

Title: Monitoring cruise report with r/v Gunnar Thorson in the Sound, the Arkona Sea, the Belt Sea and the Kattegat. Cruise no. GT 252, 25-29 January 2010

Author: Colin A. Stedmon
Department: Department of Marine Ecology
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Aarhus University
Frederiksborgvej 399
P.O. Box 358
DK-4000 Roskilde
Denmark
Tel. +45 4630 1200
E-mail: dmu@dmu.dk
www.neri.dk

Monitoring Cruise Report - Cruise No. GT 252, 25-29 January 2010

Report author: Colin A. Stedmon

Cruise leader: Kjeld Sauerberg

Participants: Dorete W. Jensen
Gitte Jacobsen
Jan Damgaard

Vessel: R/V Gunnar Thorson

Sampling region: The Sound, the Arkona Sea, the Belt Sea and the Kattegat

Primary aim: Monitoring of winter nutrient concentrations

This report is based on preliminary data, which might later be corrected. Citation permitted only when quoting is evident.

Introduction

The cruise is part of the Danish national monitoring programme (NOVA-NA), the HELCOM monitoring programme (COMBINE) for the Baltic Sea area, and the OSPARCOM monitoring programme (JAMP) for the Greater North Sea (the Kattegat). The primary aim of the cruise is to provide measurements of winter hydrography and nutrient concentrations. *Figure 1* shows the locations of the monitoring sampling stations.



Figure 1 Map showing the stations sampled by the monitoring cruise, region sea names and the location of the transects plotted in the following figures.

Meteorology

Monthly averages for air temperature are shown in *Figure 2*. During winter mean air temperatures fluctuated from being 2.6 degrees above average in November to 3.2 degrees below average in January 2010. Monthly precipitation exhibited a similar pattern with approximately 60% greater than average for November and 50% less precipitation than expected in January.

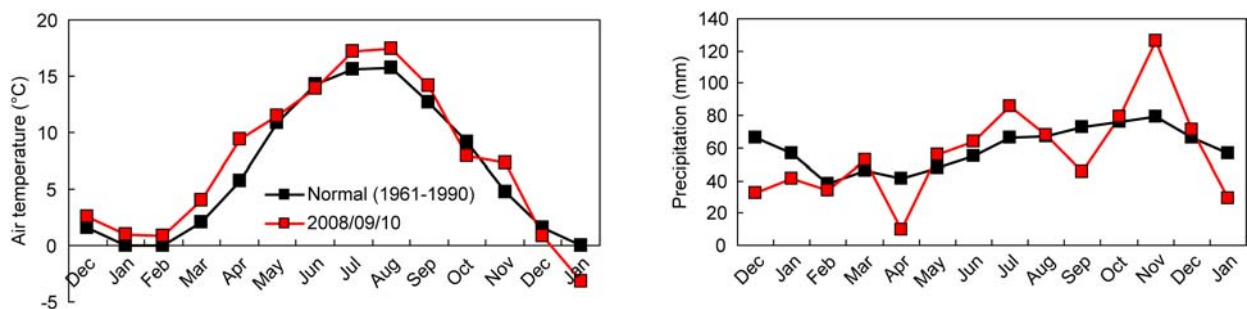


Figure 2 Monthly average air temperature and monthly total precipitation data for December 2008 to January 2010 compared with long-term averages (1961-1990). Data retrieved from the Danish Meteorological Institute (www.dmi.dk).

The weather for the weeks preceding the cruise is shown in *Figure 3*. As seen in the monthly data, the weather in the period before the cruise was colder than average for eight consecutive weeks. For the same period wind speeds were generally below that expected for this time of year.

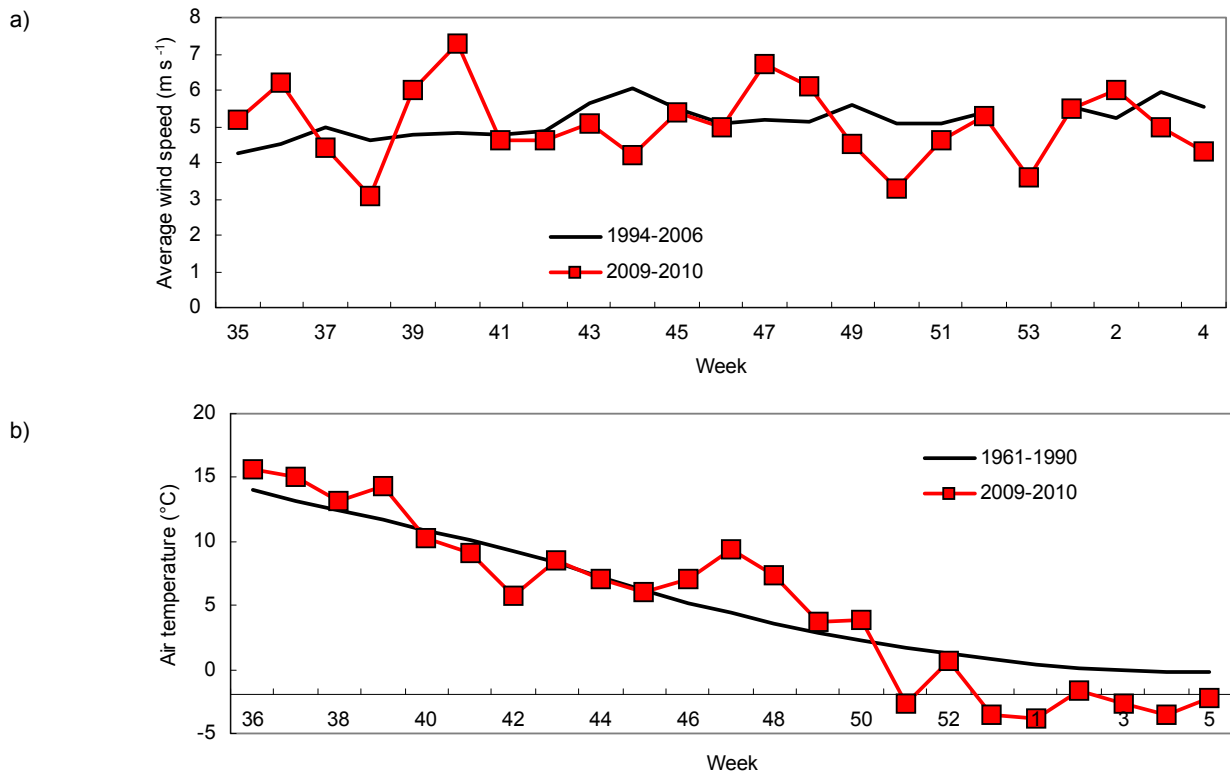


Figure 3 a) Weekly average wind speed from mid-March to the week of the cruise compared with average values from 1994-2006. b) Weekly air temperature from the same period compared to average values from 1961-1990. This cruise was in week 4.

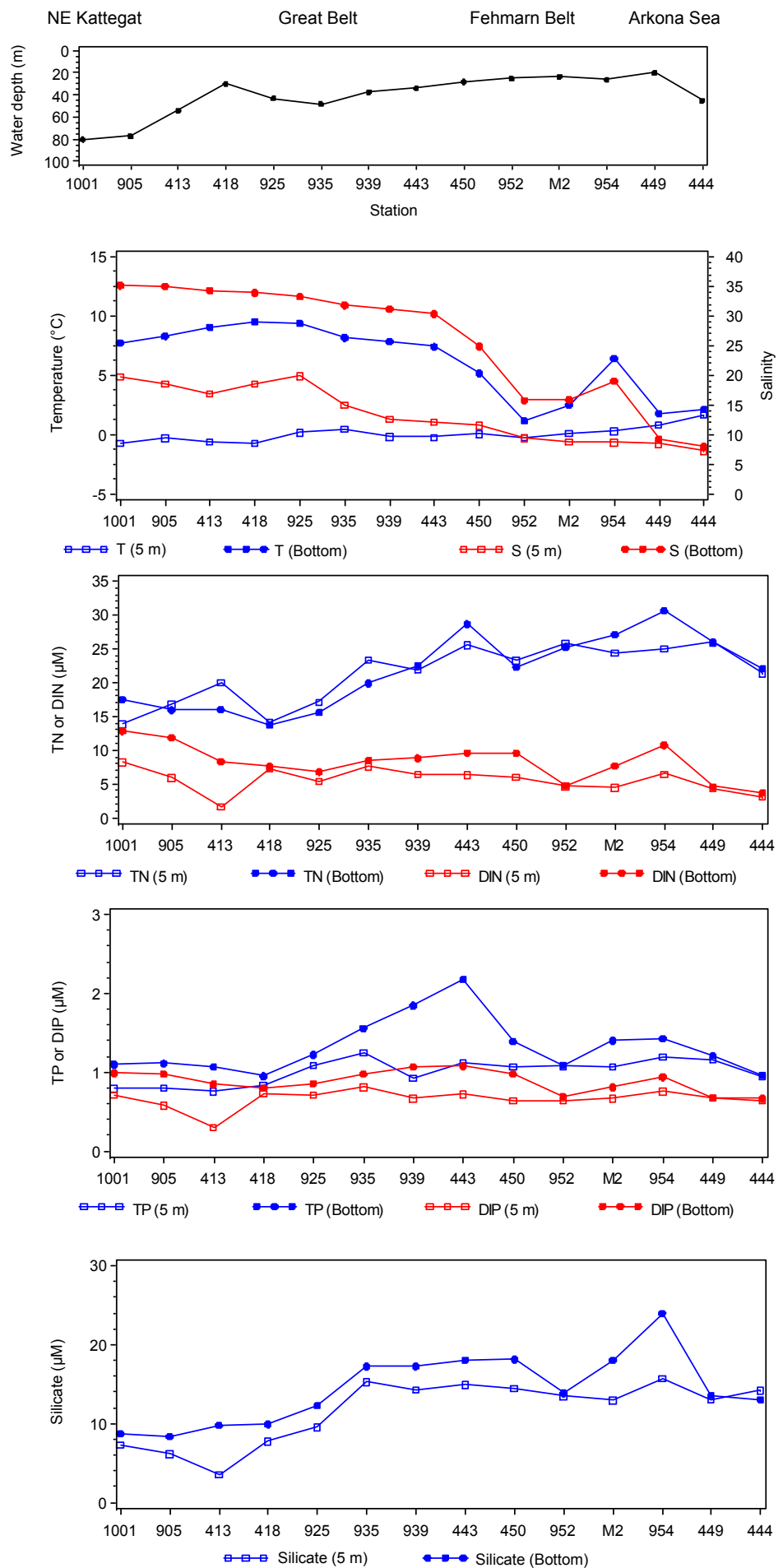
Hydrography

A transect that summarises the horizontal gradients in the hydrographic and nutrient measurements is presented in *Figure 4* and the locations of the transect is marked on *Figure 1*.

Surface water temperatures varied between -0.8 to 1.9 degrees for the stations visited (*Figure 4*). In general surface water temperatures increased from West to East. Bottom waters were in general warmer with temperatures above 9 degrees in bottom waters of the Southern Kattegat and the Sound (St. 413, 418, 921 and 431). Bottom waters of the Northern Kattegat were slightly colder ranging between 7.8-9.1. In comparison to previous years the surface waters were significantly colder and bottom waters were significantly warmer (See Appendix, St. 413, 431, 939, 925, 1001).

Surface water salinities increased from East to West as expected, with values between 7.25-9.43 in the Fehmarn Belt-Arkona Sea region, 11.56-14.94 in the Great Belt and greater than 16.8 in the Kattegat (*Figure 4*). The surface waters of the Kattegat and Great Belt were generally less saline than expected for this time of year (Appendix, St. 1001, 939, 413). In the Arkona Sea (St. 444) bottom water salinities were very similar to surface water values indicating a well mixed water column (See Appendix, St. 444). In the Fehmarn Belt-Mecklenburg Bight region bottom water salinities increased from 8.6 to 24.9 and in the Great Belt and Kattegat bottom water salinities were generally greater than 25 (*Figure 4*).

Figure 4 Transects of surface and bottom water temperature, salinity and nutrient concentrations. Position of the transect is indicated in *Figure 1*.



Nutrients

There were no noteworthy trends in total nitrogen concentrations (TN) with depth. Surface TN concentrations ranged between 13.3-30.1 μM and bottom water concentrations ranged similarly between 13.7-30.6 μM . In general concentrations decreased from East to West with slight local increases in the Southern Belt Sea. Values were within the range expected for this time of year, except for St. 444 where TN was slightly higher than normal (Appendix, St. 444). Dissolved inorganic nitrogen (DIN) concentrations were slightly greater in bottom waters than in surface waters. Bottom water concentrations ranged between 3.73-12.84 μM and lowest concentrations were measured at St. 444 in the Arkona Sea. Surface water concentrations ranged between 1.62-7.61 μM , with lowest concentrations measured at stations in the Kattegat where phytoplankton spring bloom had already started (*Figure 5*).

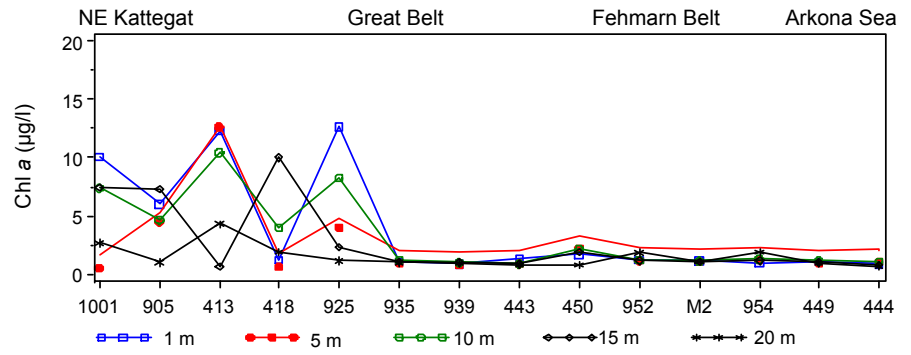
Total phosphorus (TP) concentrations were only slightly greater in bottom waters than surface waters, except for stations in the Great Belt (St. 935, 939, 443) where bottom water concentrations were between 0.5-1 μM greater than surface water values. Dissolved inorganic phosphorus followed a very similar trend to that described for DIN above. Bottom water concentrations were slightly higher and relatively constant, varying between 0.52-1.08 μM . Surface concentrations were slightly lower and lowest values were associated with areas where phytoplankton bloom had started.

Silicate concentrations were greatest in the Great Belt, Southern Belt Sea and Arkona Sea. Here surface concentrations ranged between 12.9 and 15.7 μM and bottom water concentrations between 13.1 and 18.1 μM . In the Kattegat concentrations were notably lower 3.5-9.5 μM and 8.4-9.9 μM , respectively. As with DIN and DIP, surface silicate concentrations were lower at the Kattegat stations with high phytoplankton concentrations.

Chlorophyll a

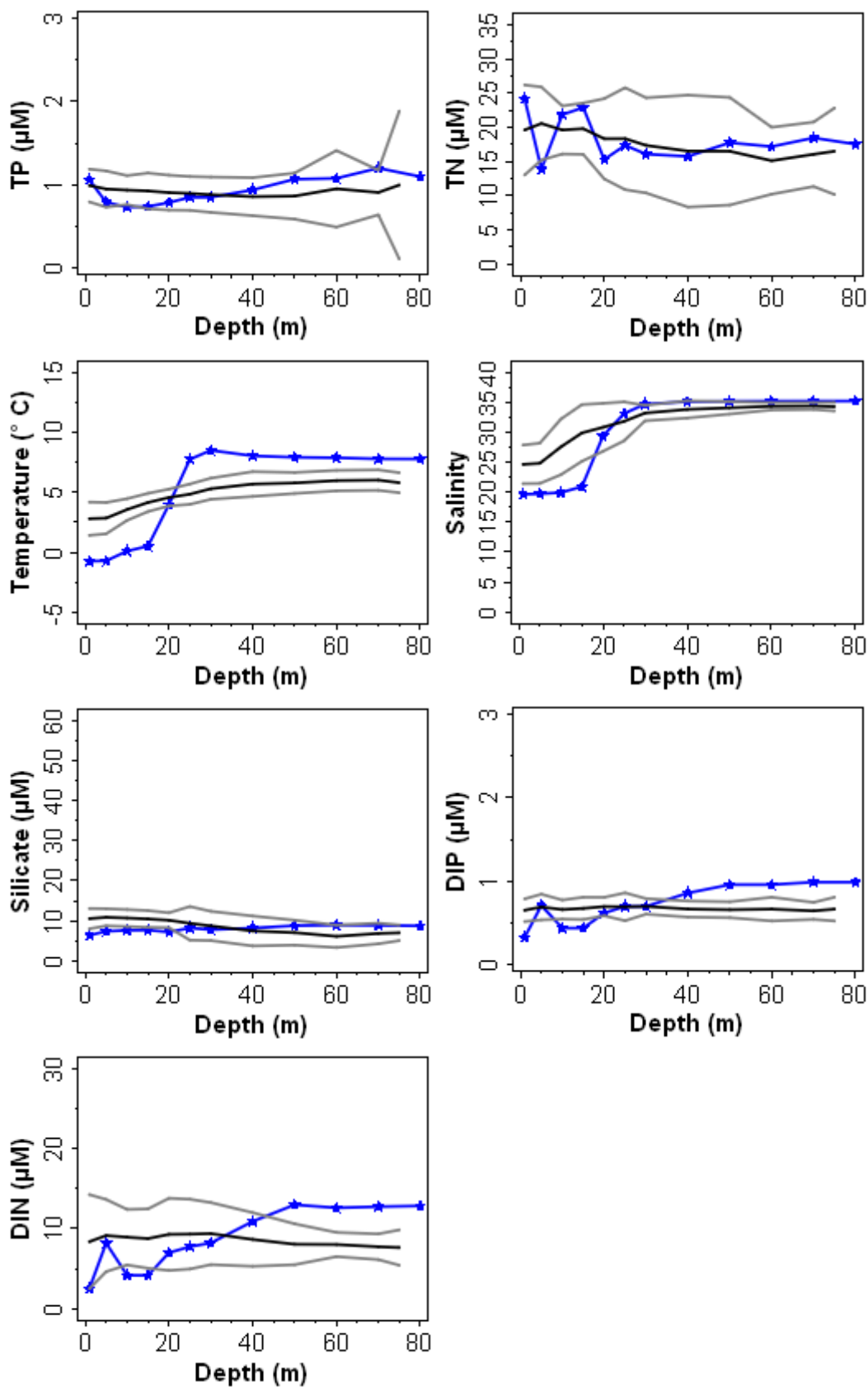
In the Kattegat it was evident that the phytoplankton "spring" bloom had already started (*Figure 5*). Chlorophyll *a* concentrations up to 15.2 $\mu\text{g}/\text{l}$ were measured. Normally concentrations are below 1 $\mu\text{g}/\text{l}$ at this time of year. In the Great Belt, Southern Belt Sea and Arkona Sea the bloom was not yet fully started. Chlorophyll concentrations were still below 2.5 $\mu\text{g}/\text{l}$ which is more common for this time of year.

Figure 5 Chlorophyll *a* concentrations in surface waters along the transect shown in *Figure 1*.

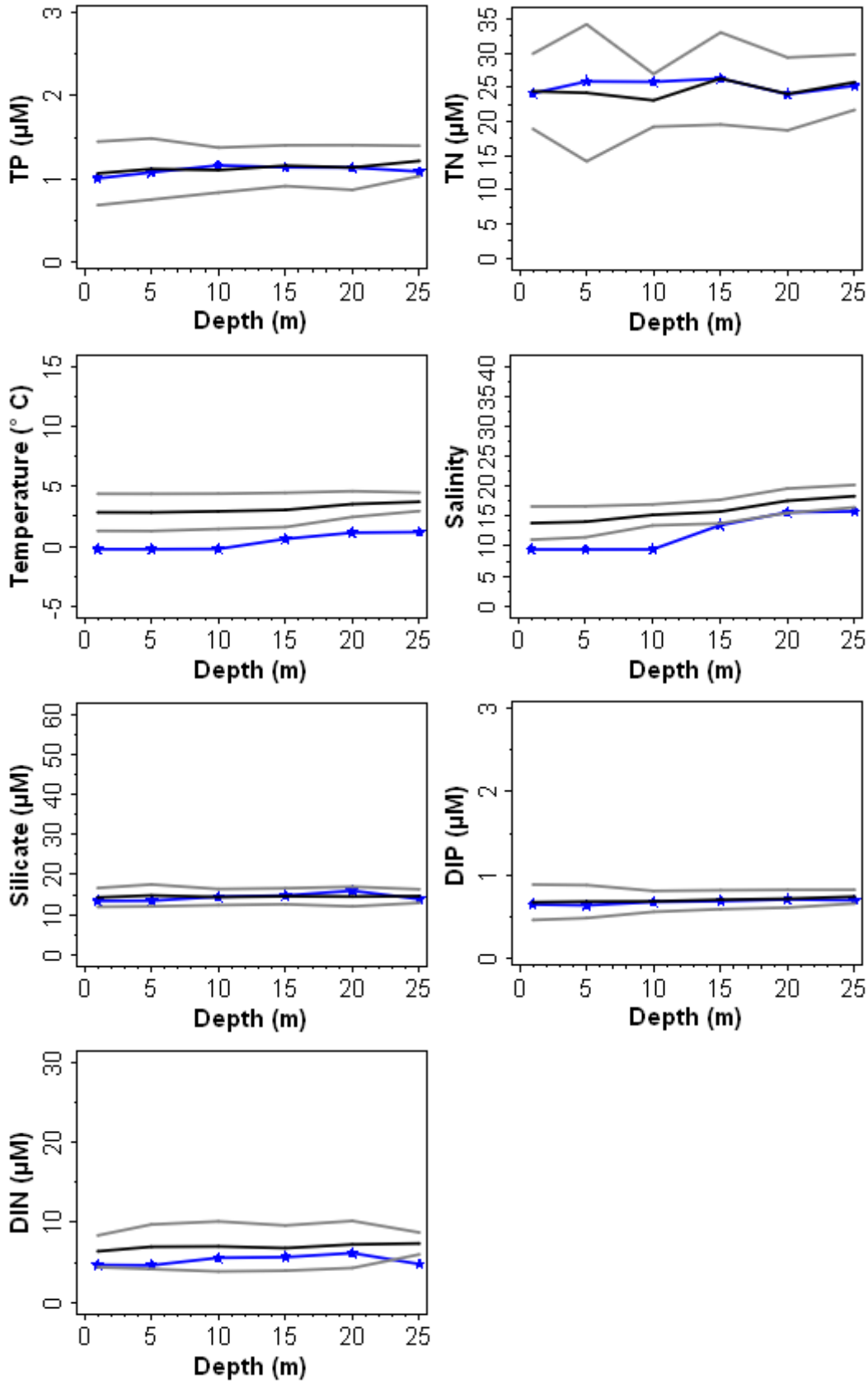


Appendix

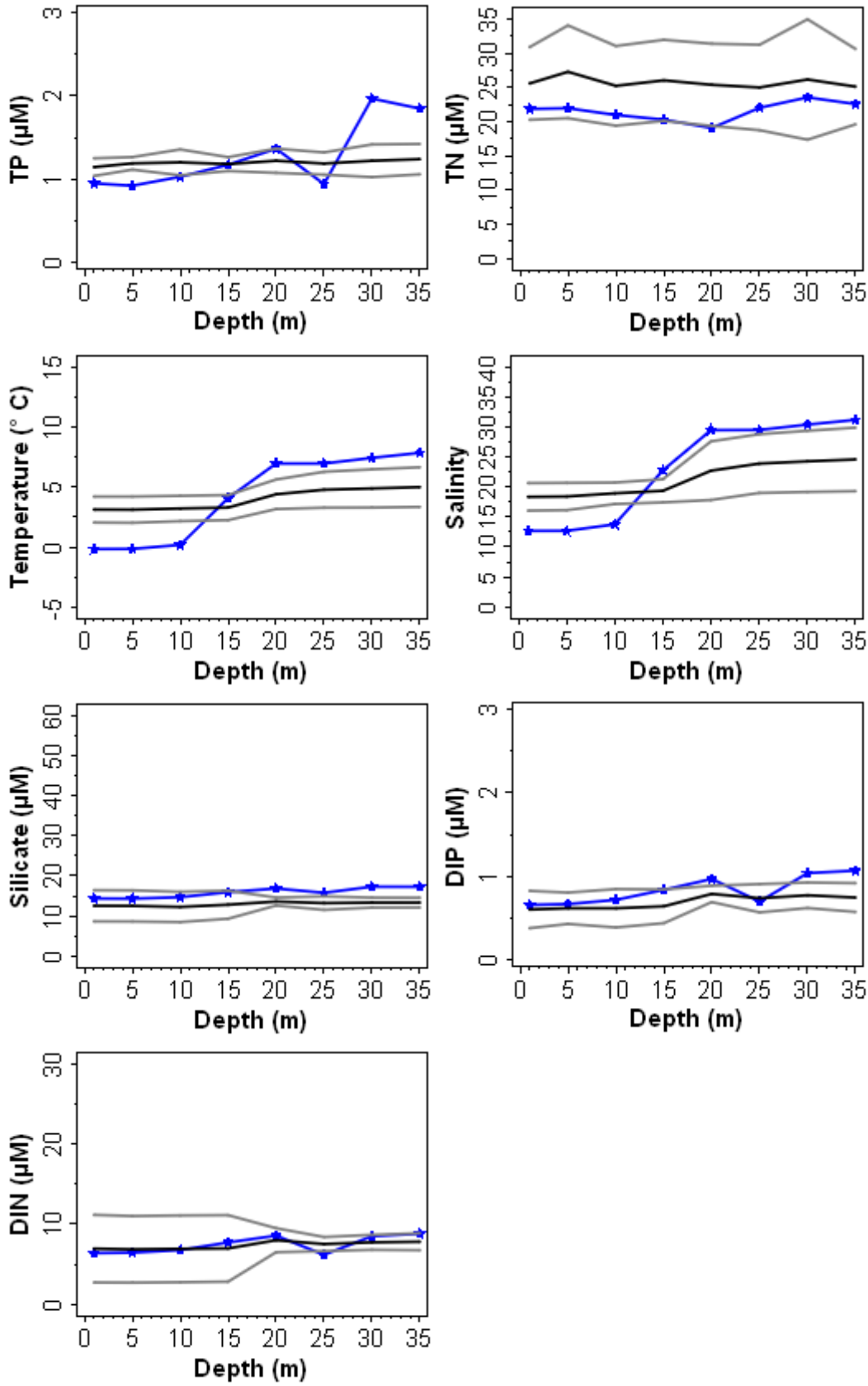
The following graphs show profiles of the measured parameters at seven chosen stations (blue lines). The mean profiles are also plotted for the station from the same cruise during the period 2004-2009 (black). The grey lines are the upper and lower 95% confidence limits for the mean.

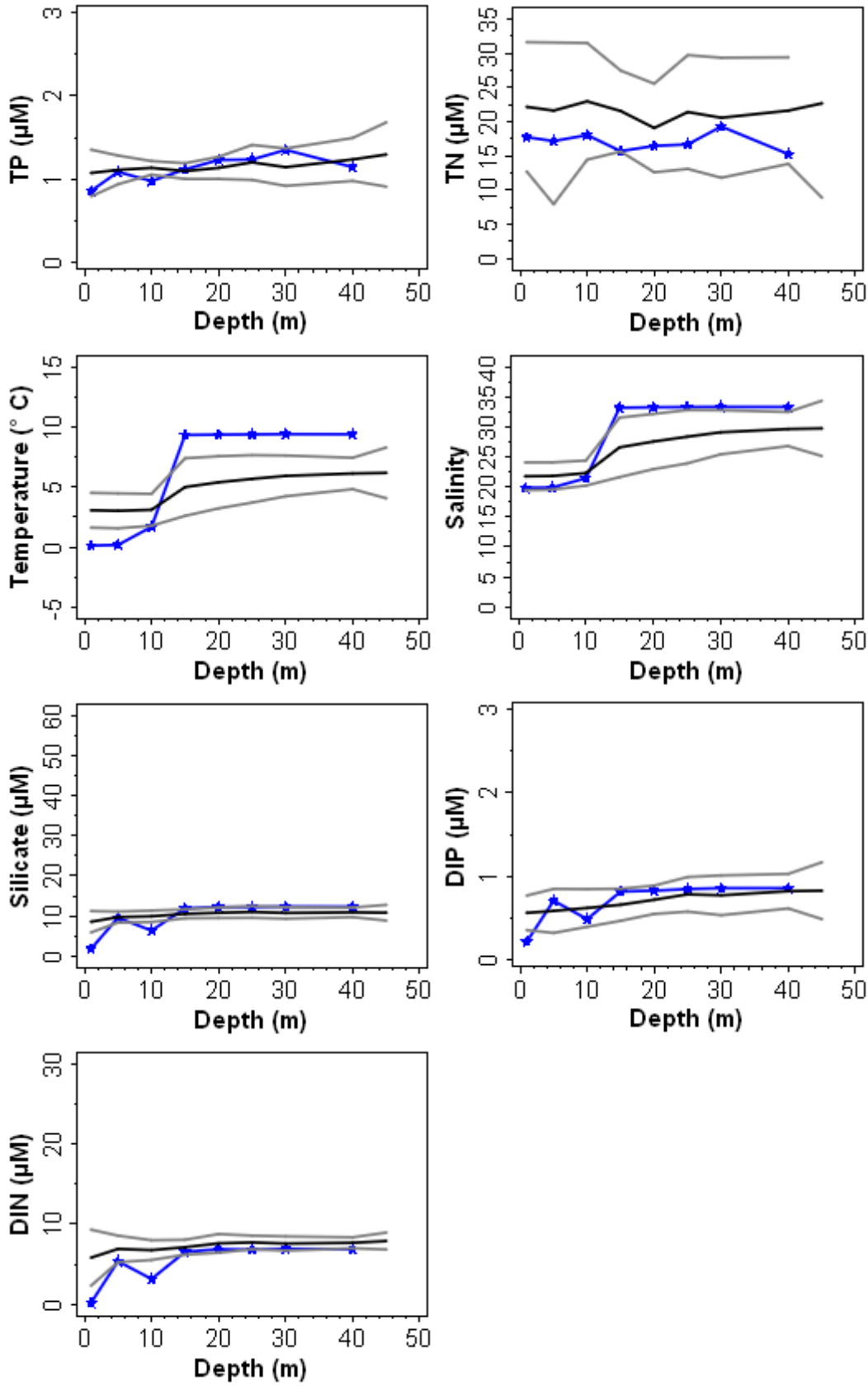


St. 952, GT 252, January 2010

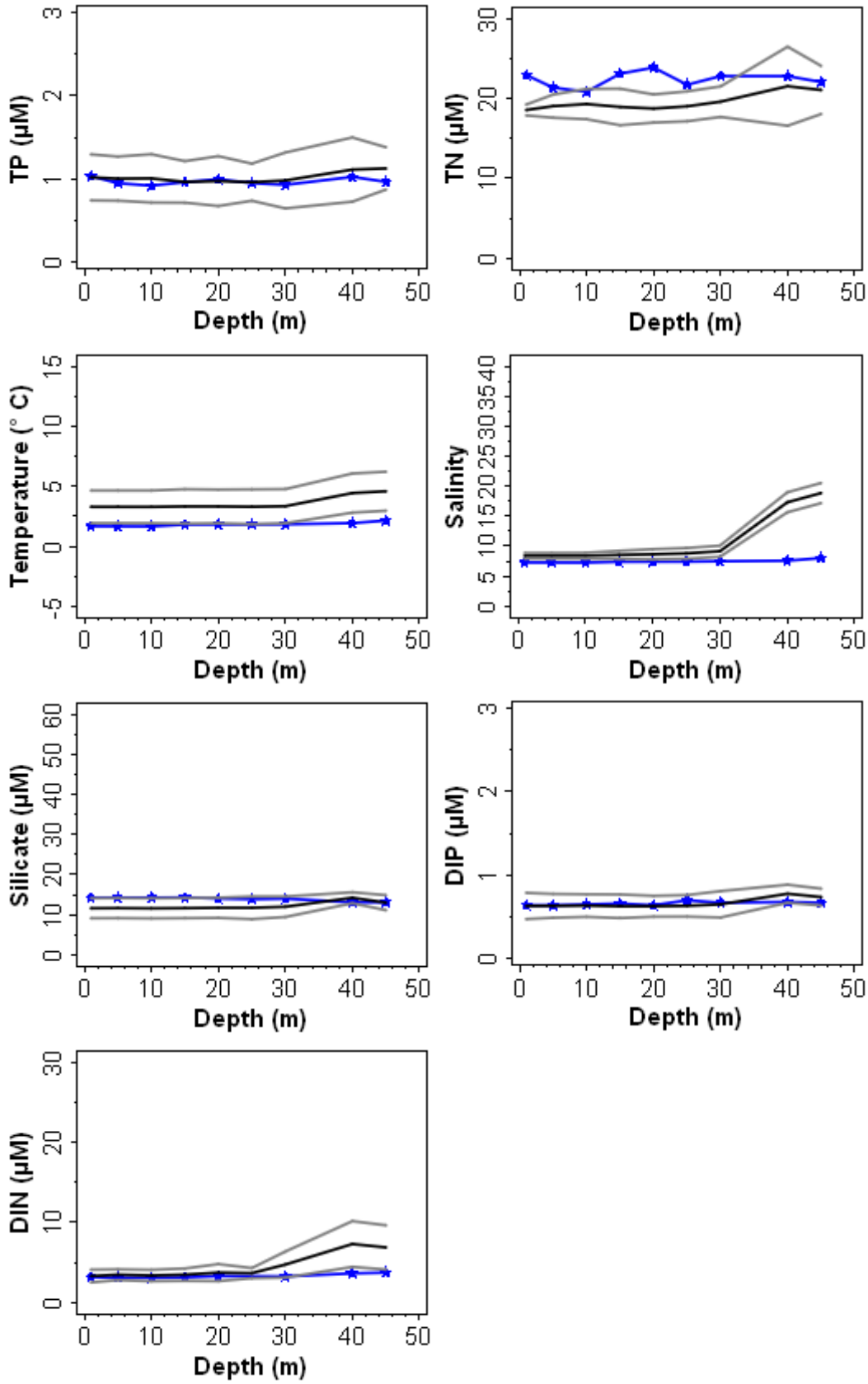


St. 939, GT 252, January 2010

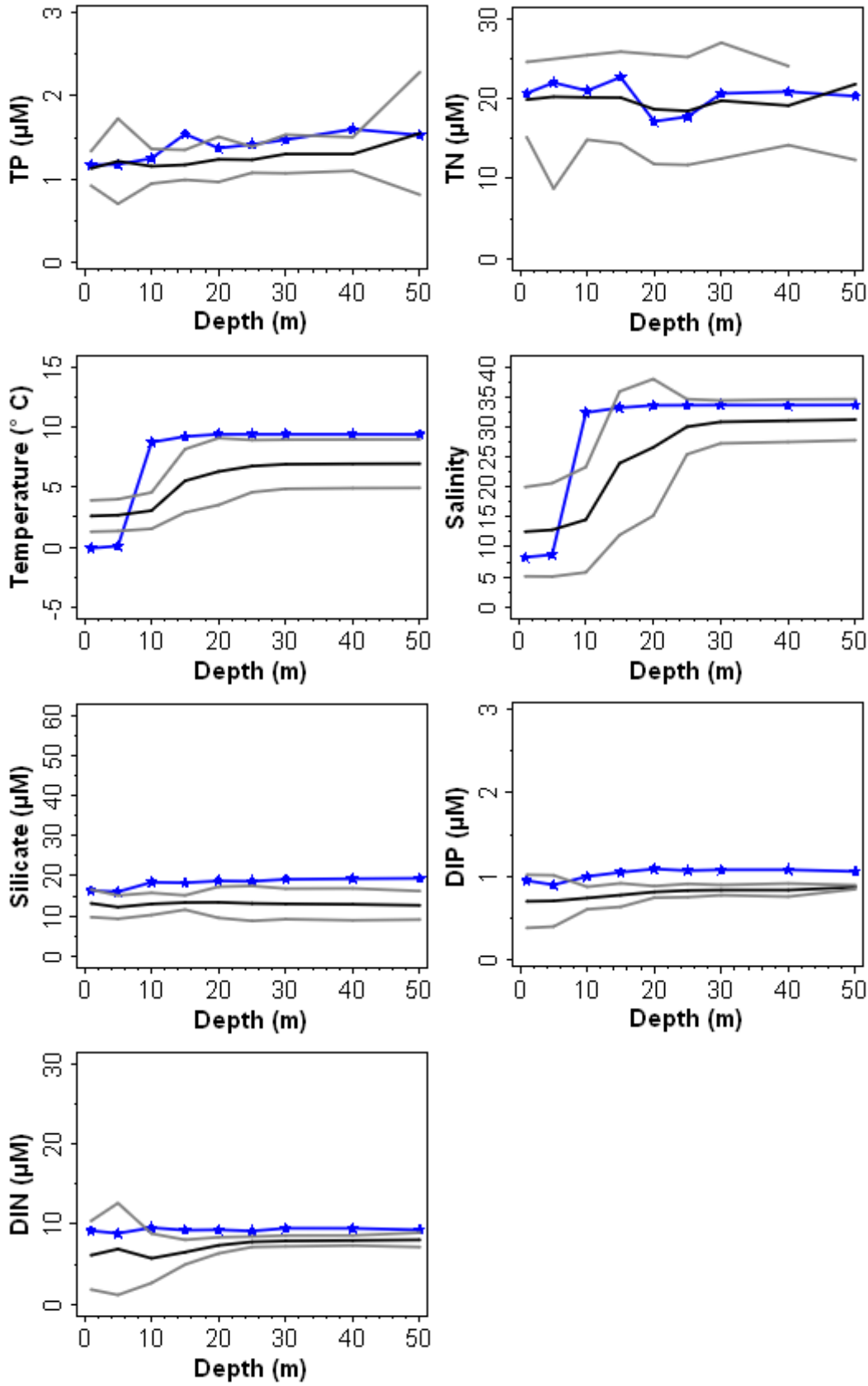




St. 444, GT 252, January 2010



St. 431, GT 252, January 2010



St. 413, GT 252, January 2010

