



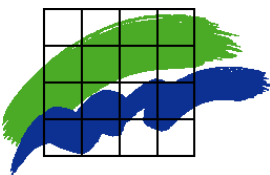
r/v Gunnar Thorson

# Monitoring Cruise Report

**Cruise No.: GT 248**

**Time: 19 - 23 January 2009**

**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](http://www.neri.dk)

## Data sheet

Title: Monitoring Cruise Report - Cruise No. GT 248, 19 - 23 January 2009

Author: Colin A. Stedmon  
Department: Department of Marine Ecology  
Serial title: Monitoring Cruise Report

Publisher: National Environmental Research Institute ©  
Aarhus University  
URL: <http://www.neri.dk>

Week/year of publication: 12/2009

Please cite as: Stedmon, C.A. 2009: Monitoring Cruise Report - Cruise No. GT 248, 19 - 23 January 2009. National Environmental Research Institute, Aarhus University, Denmark. 15 pp. – Monitoring Cruise Report.

Reproduction is permitted, provided the source is explicitly acknowledged.

Keywords: Marine, monitoring, hydrography, eutrophication

Layout: Anne van Acker  
Drawings: Colin A. Stedmon

ISSN (electronic): 1600-1656

Number of pages: 15

Remark: The numbers of the monitoring cruises may not be successive, as the numbers also include other types of cruises.

Internet-version: The report is available in electronic format at NERI's website  
<http://www.dmu.dk/Vand/Havmiljoe/Togtrapper/>

Published by: National Environmental Research Institute  
Aarhus University  
Frederiksborgvej 399  
P.O. Box 358  
DK-4000 Roskilde  
Denmark  
Tel. +45 4630 1200  
E-mail: [dmu@dmu.dk](mailto:dmu@dmu.dk)  
[www.neri.dk](http://www.neri.dk)

# Monitoring Cruise Report - Cruise No. GT 248, 19 - 23 January 2009

Report author: Colin A. Stedmon

Cruise leader: Dorete W. Jensen

Participants: Dorete W. Jensen  
Gitte Jacobsen  
Peter Kofoed  
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.

## Summary

The meteorological conditions during winter have generally been warmer and dryer than average. The water column was stratified at all stations, except for the Mecklenburg Bight. From the Fehmarn Belt and eastwards, the stratification was due to a halocline alone as surface and bottom water temperatures were the same. The bottom waters in the Southern Kattegat were notably warmer than expected for this time of year. Nutrient concentrations in surface and bottom waters were greatest in the Belt Sea region reflecting the effects of local inputs. TN concentrations were generally lower than expected in the waters of the Fehmarn Belt, the Great Belt, the Sound and Southern Kattegat. Bottom water oxygen concentrations were above 5 ml/l for all stations and generally controlled by temperature (solubility).

## Introduction

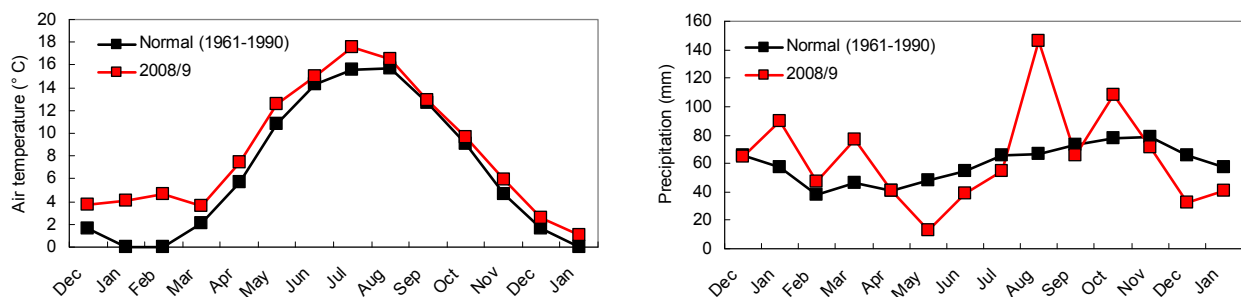
The cruise is part of the Danish national monitoring programme (NO-VANA), the HELCOM monitoring programme (COMBINE) for the Baltic Sea area, and the OSPARCOM monitoring programme (JAMP) for the Greater North Sea (the Kattegat). The primary aim of the cruise is to provide measurements of hydrography, and nutrient concentrations. *Figure 1* shows the locations of the monitoring sampling stations.



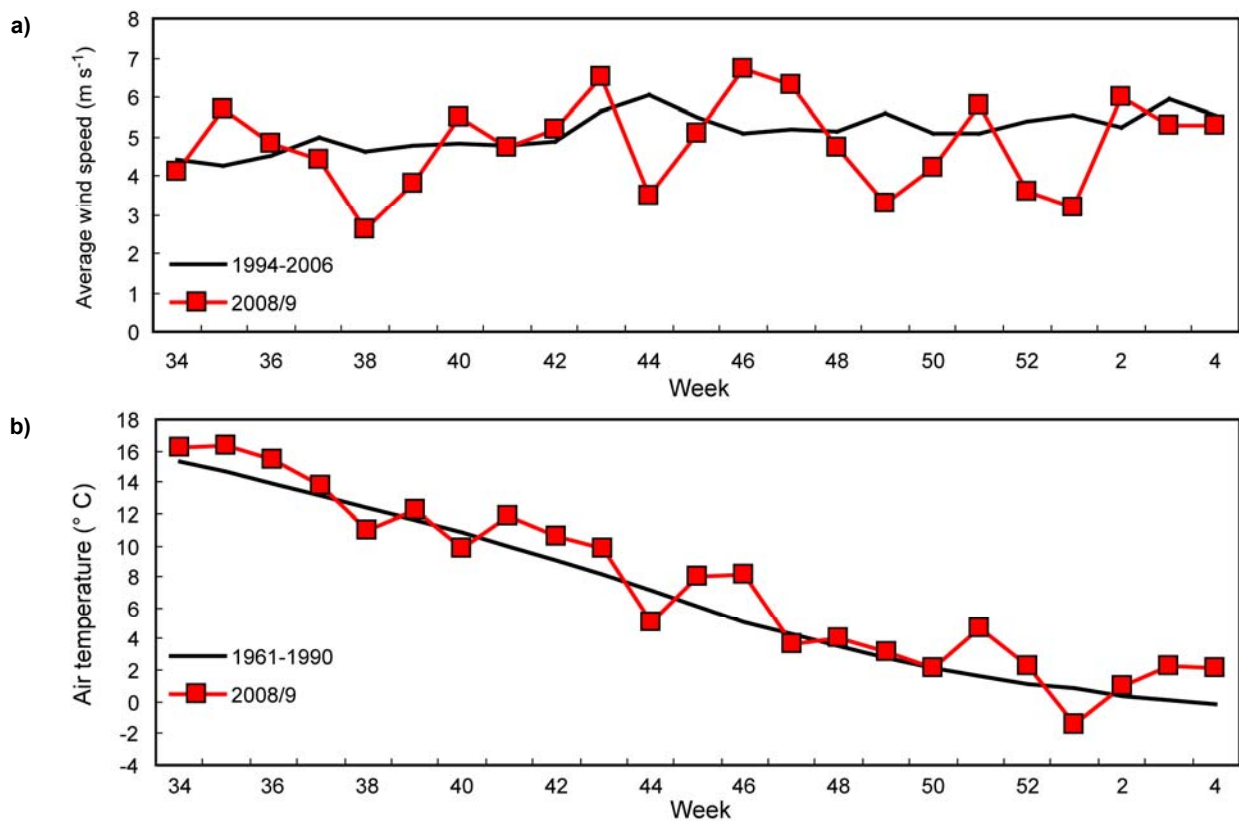
**Figure 1** Map showing the stations sampled by the monitoring cruise, regional sea names and the location of the transect plotted in the following figures.

## Meteorology

For the months of November, December 2008 and January 2009 average monthly air temperatures have been approximately 1 degree C above the long term mean (*Figure 2*). In addition for these months there has been 8 and 34 mm less precipitation than normal (*Figure 2*). Weekly average wind speeds from the start of December 2008 have generally been below average expected for this time of year, apart from weeks 51 (mid December 2008) and week 2 (*Figure 3*). The two weeks preceding the cruise were characterised by slightly warmer temperatures and average winds of this time of year (*Figure 3*).



**Figure 2** Monthly average air temperature and monthly total precipitation data for the last 13 months compared with long-term averages (1961 - 1990). Data retrieved from the Danish Meteorological Institute ([www.DMI.dk](http://www.DMI.dk)).



**Figure 3** a) Weekly average wind speed from mid-August last year 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 5. Data retrieved from the Danish Meteorological Institute ([www.DMI.dk](http://www.DMI.dk)).

## Hydrography

Surface water ( $\leq 5\text{m}$ ) temperatures were relatively constant and ranged between 2.7 - 4.9 degrees C across all stations sampled. Values along the transect (see *Figure 1*) are shown in *Figure 4*. Bottom waters were generally warmer ranging between 2.8 to 8.3 degrees C. Surface water salinities increased from 8.3 at Arkona in the East to 22.7 in the Northern Kattegat. Bottom water salinities varied from 19.1 in the Arkona Sea, then falling to 12.3 in the Mecklenburg Bight and increasing to 34.8 in the Northern Kattegat.

The water column was stratified at all stations except for M2 in the Mecklenburg Bight. From the Fehmarn Belt to the Arkona Sea there were little or no differences in surface and bottom water temperatures (i.e. no thermocline), however, the halocline persisted at depth. Bottom waters in the Southern Kattegat were warmer and more saline than normal for this time of year (see *Appendix St. 925*).

## Nutrients

Total nitrogen (TN) concentrations were greatest in the waters of the Arkona Sea to the Great Belt, ranging between 19 - 23  $\mu\text{M}$  and there were no large differences between surface and bottom water concentrations (*Figure 4*). In the Kattegat surface water TN concentrations were slightly lower ranging between 13 - 19  $\mu\text{M}$  and even lower in the bottom waters

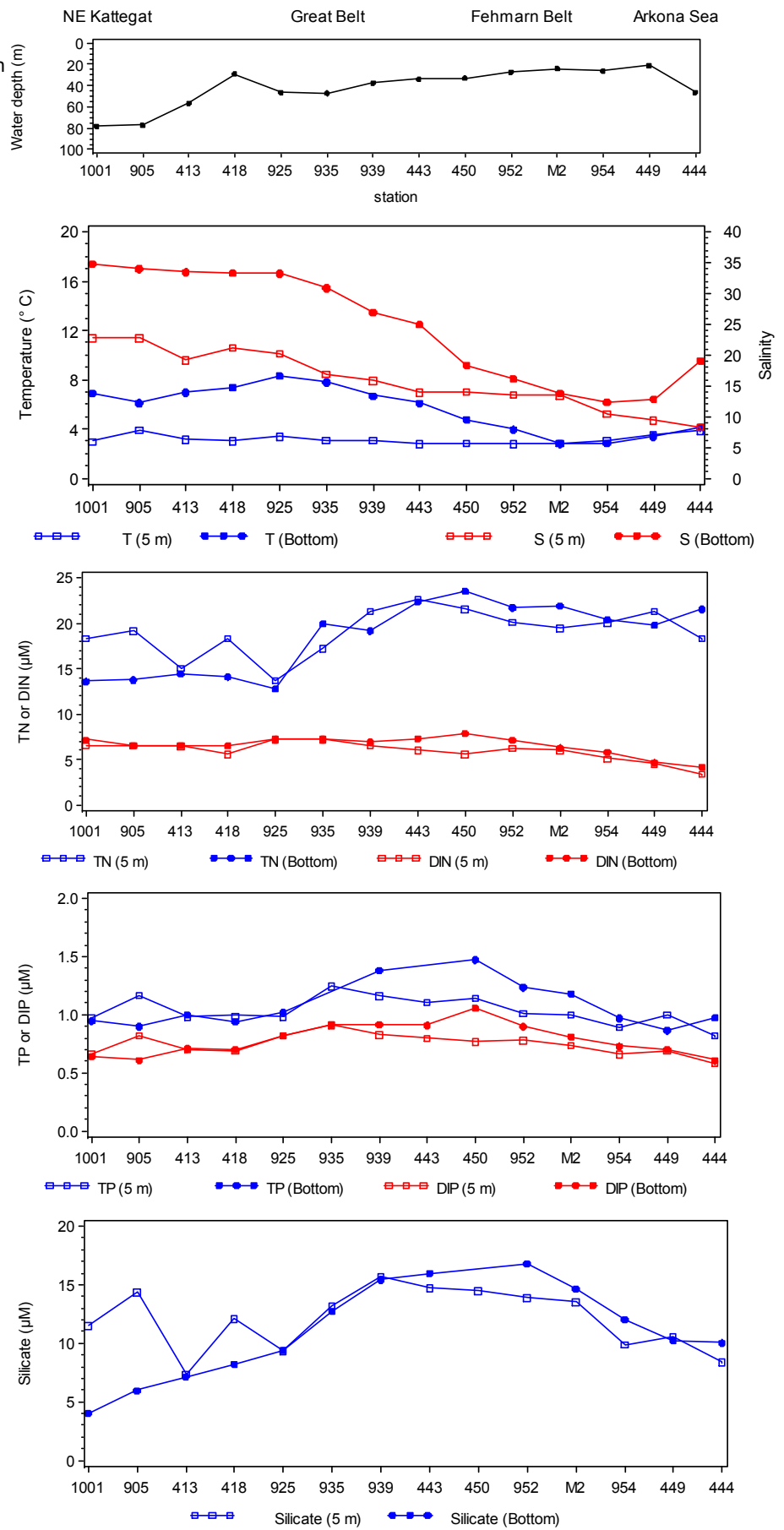
(13 - 14  $\mu\text{M}$ ). In comparison to previous years, TN concentrations were generally lower than expected in the waters of the Fehmarn Belt, the Great Belt, the Sound and Southern Kattegat (see *Appendix*).

Dissolved inorganic nitrogen concentrations (DIN) were not notably different in surface and bottom waters. Lowest concentrations were measured in the Arkona Sea and highest concentrations measured at St. 450 in the Belt Sea. Concentrations varied between 3.4 - 7.9  $\mu\text{M}$  (*Figure 4*).

Total phosphorus (TP) concentrations ranged between 0.8 - 1.5  $\mu\text{M}$  with highest concentrations measured in the bottom waters at St. 450. Dissolved inorganic phosphorus concentrations were closely correlated to TP representing on average 73% of TP and varying between 0.6 - 1.1  $\mu\text{M}$ .

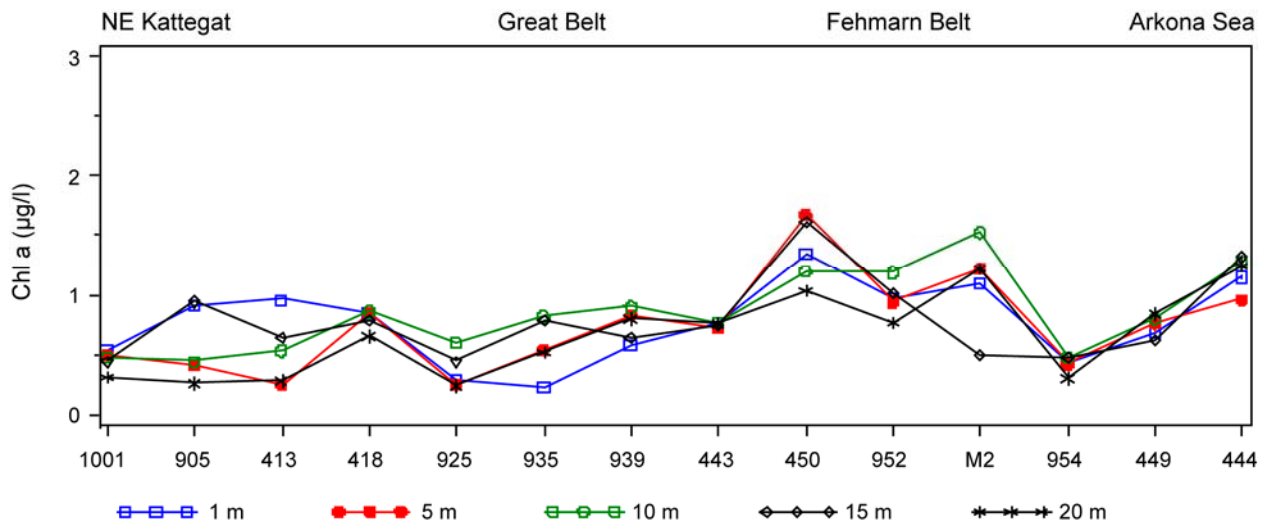
Surface water silicate concentrations were variable ranging from 7.4 to 15.6  $\mu\text{M}$ . In bottom waters, however, there was a clear increase from 4.2  $\mu\text{M}$  in the Northern Kattegat to 16.8  $\mu\text{M}$  at St. 952 in Fehmarn Belt. Further eastwards concentrations decreased to 10  $\mu\text{M}$  in the Arkona Sea.

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



## Chlorophyll *a*

Chlorophyll *a* concentrations were greatest in the Southern Belt Sea and Arkona Sea ( $>1 \mu\text{g/l}$ ) and lowest at St. 954 in the Mecklenburg Bight and St. 1001 in the Northern Kattegat ( $\sim 0.5 \mu\text{g/l}$ ).



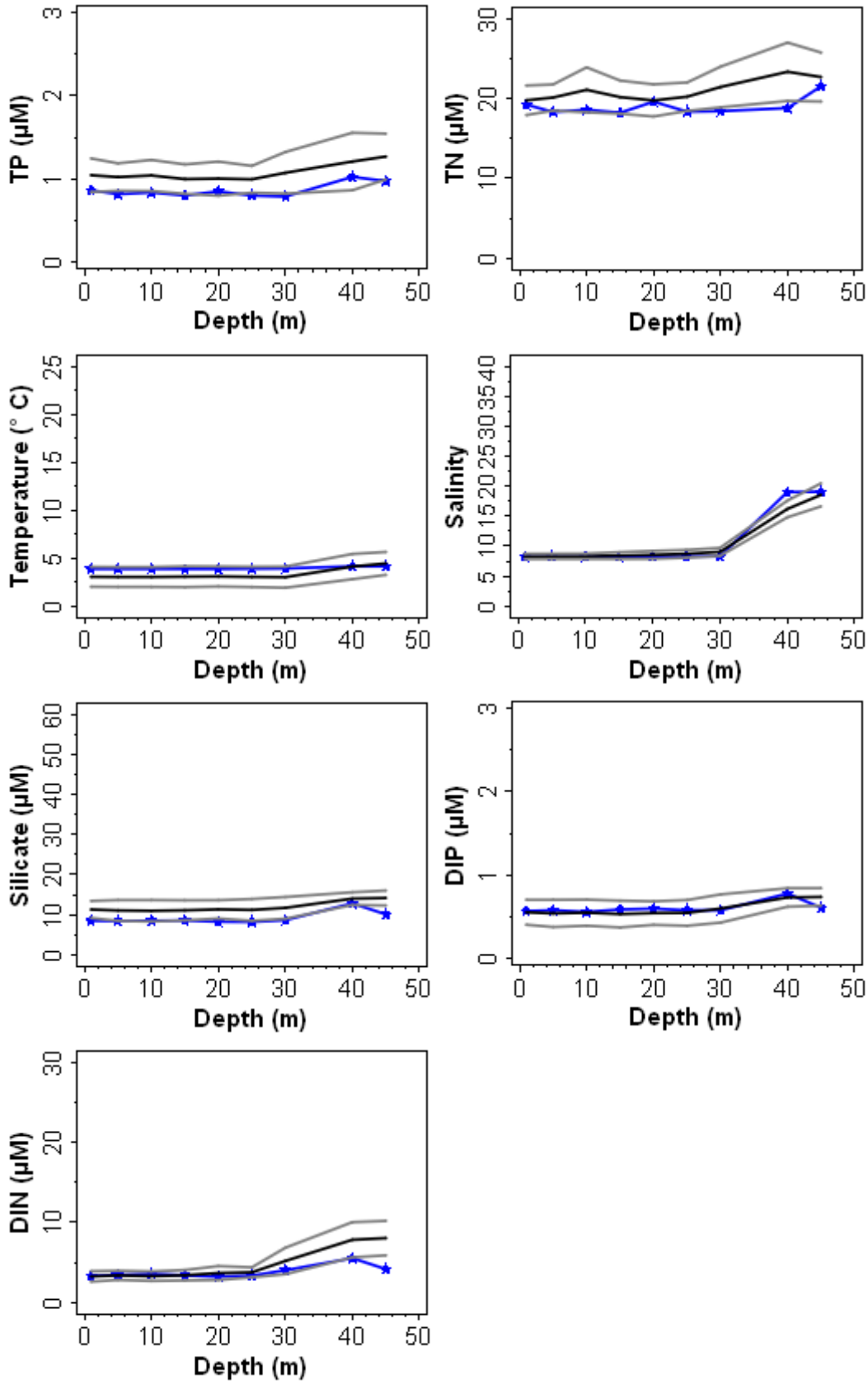
**Figure 5** Chlorophyll *a* concentrations in surface waters along the transect shown in Figure 1.

## Appendix

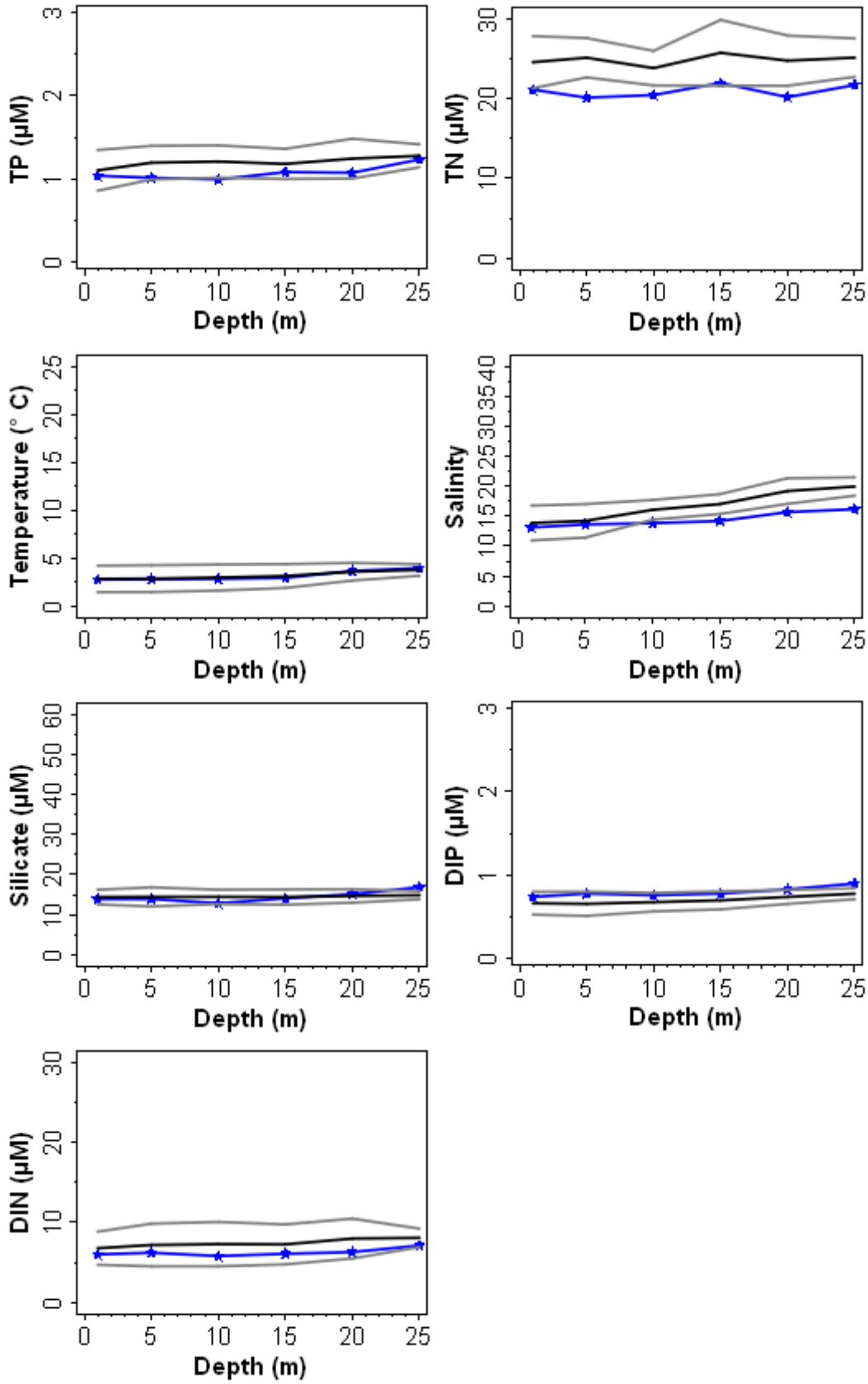
The following graphs show profiles of the measured parameters at seven chosen stations (blue lines). The mean profiles are also plotted for the station from the same cruise during the period 2001 - 2008 (black). The grey lines are the upper and lower 95% confidence limits for the mean.



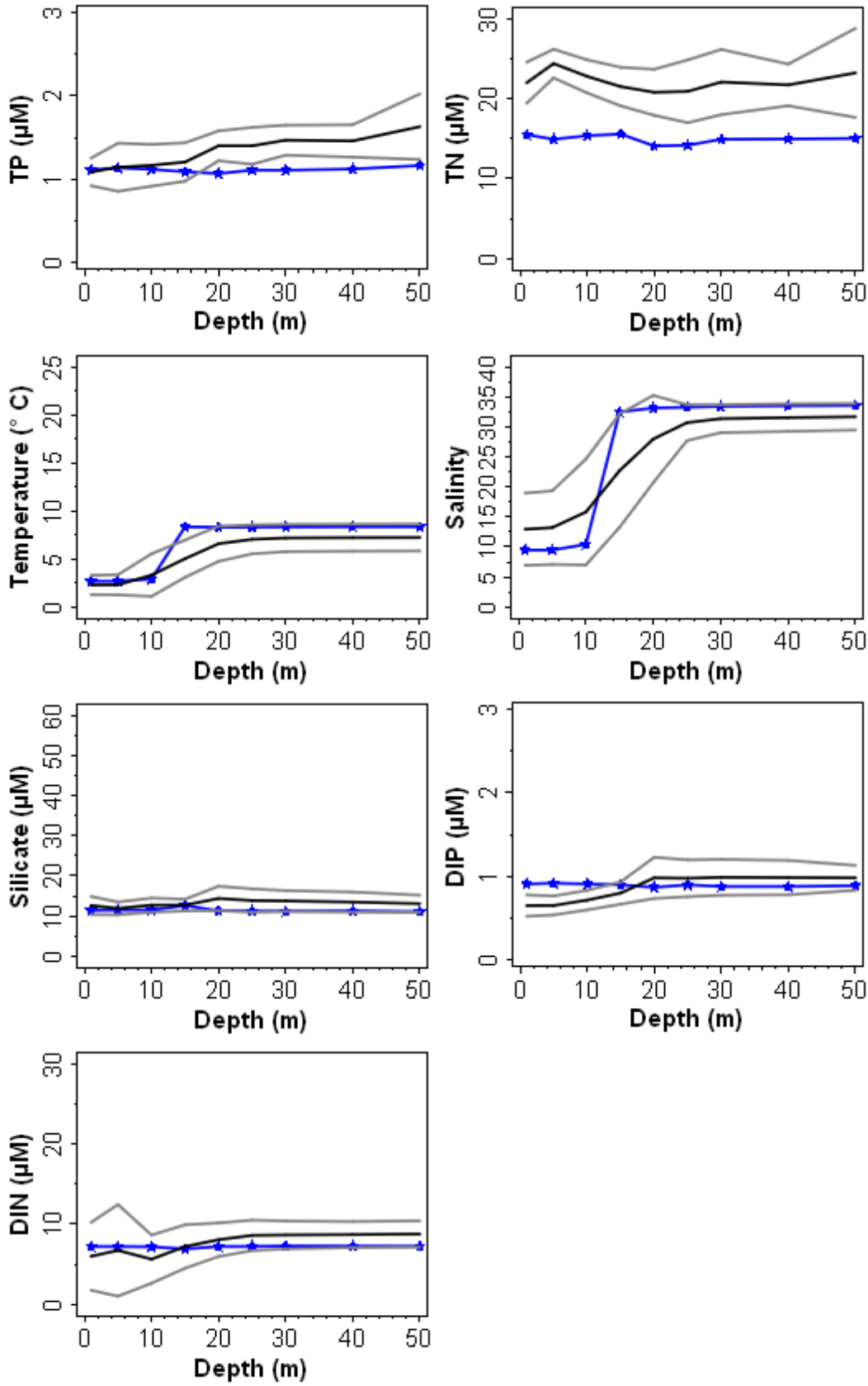
St. 444 - Arkona Sea



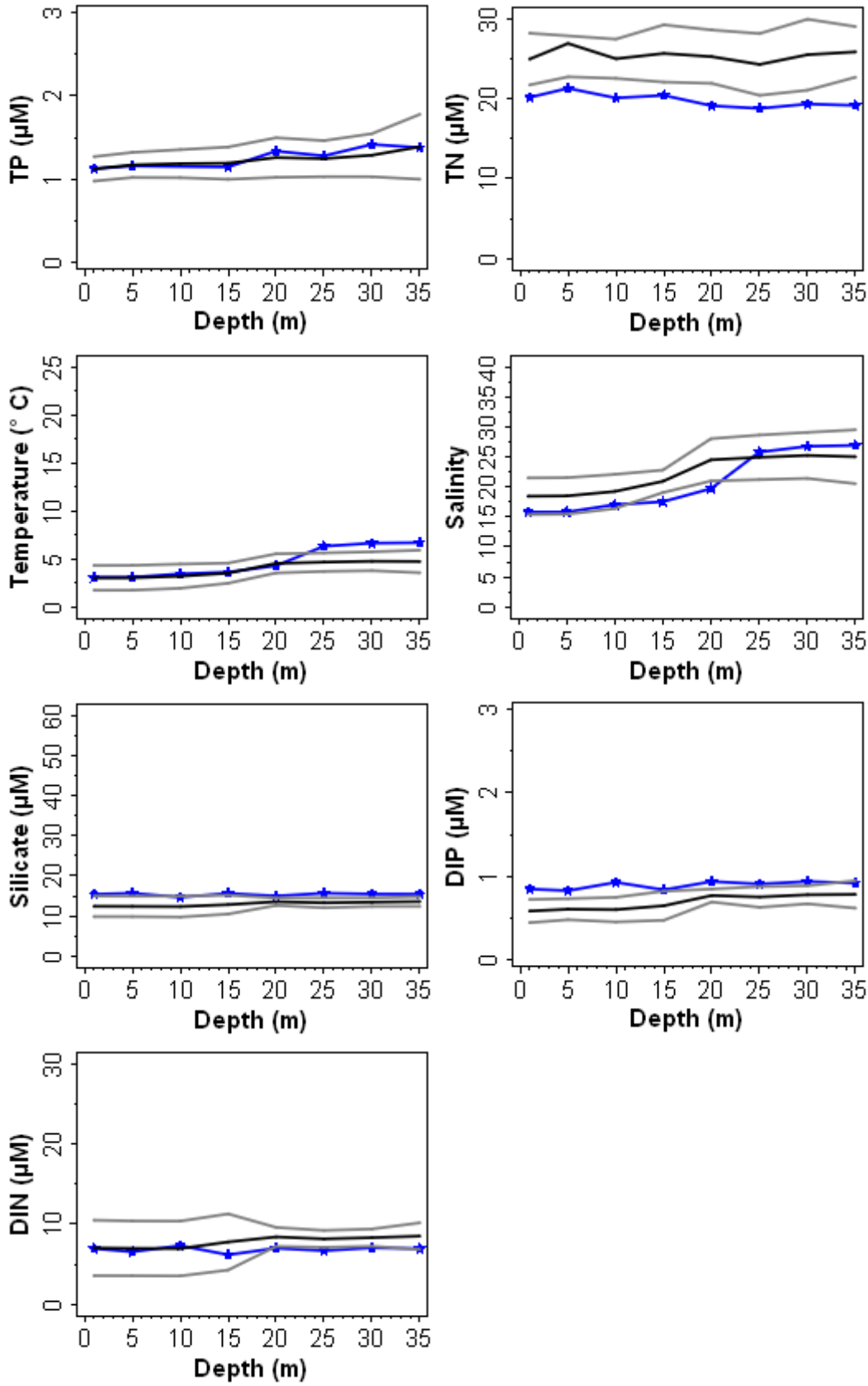
St. 952 - Fehmarn Belt



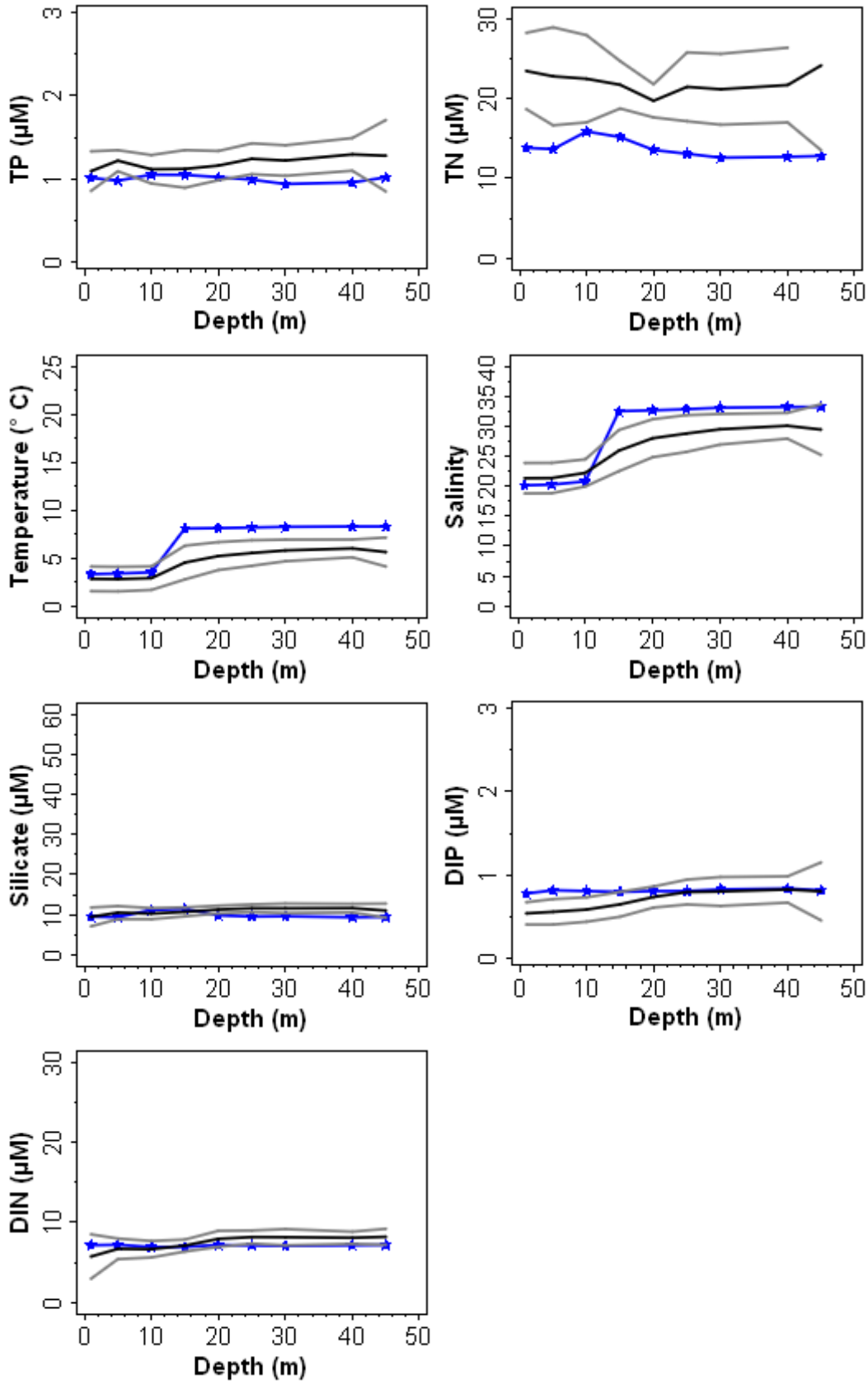
St. 431 - The Sound



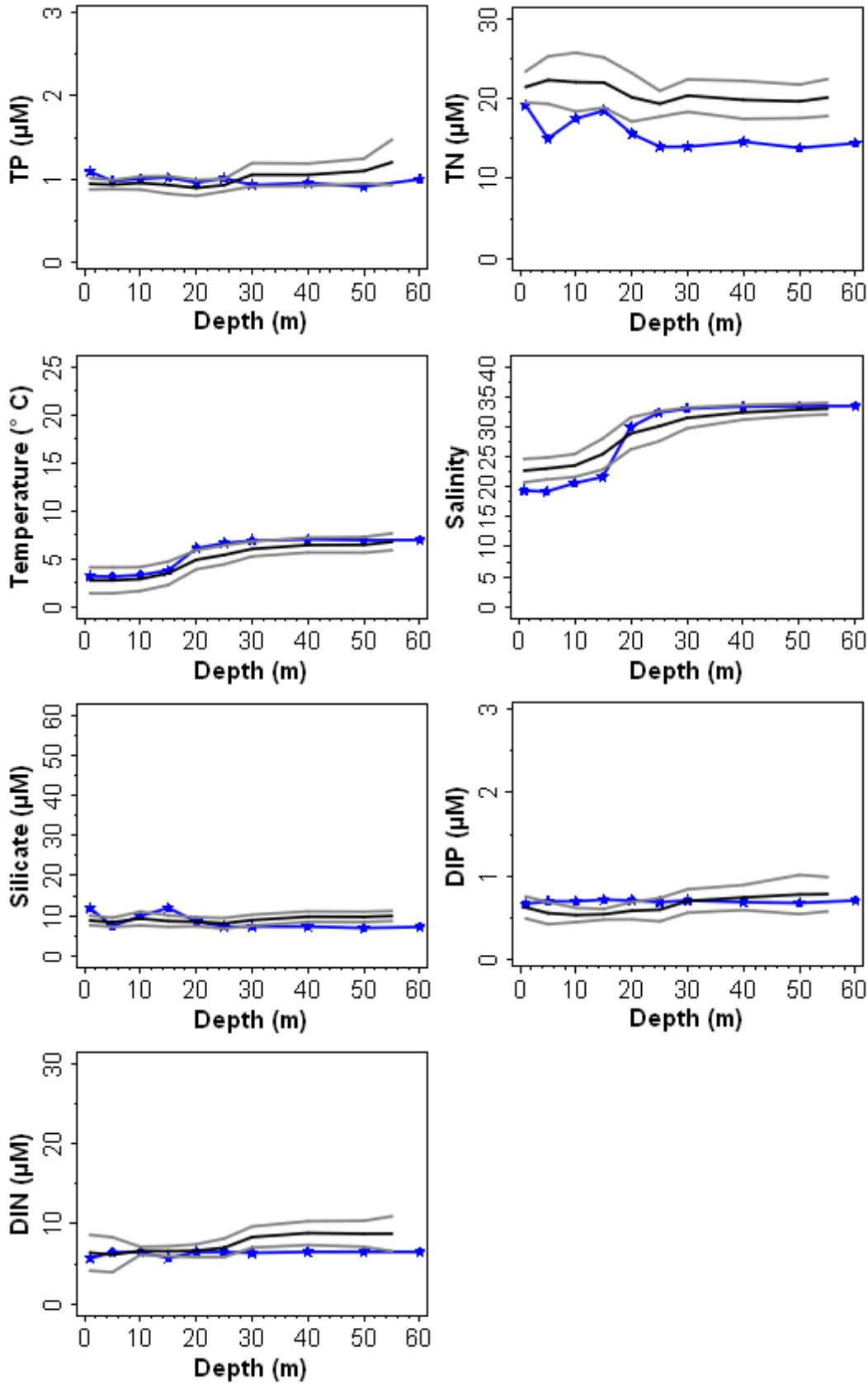
St. 939 - The Great Belt



St. 925 - Southern Kattegat



St. 413 - Central Kattegat



St. 1001 - Northern Kattegat

