Cruise Report HE-361, 12. – 29. July 2011

Chief Scientist: Dr. Meinhard Simon, ICBM, University of Oldenburg

Aim

The aim of this cruise was to assess the abundance, diversity and physiological activity of various members of the *Roseobacter* clade in te water column and surface sediment during a summer phytoplankton bloom in the northern or central North Sea.

Cruise track, stations, sampling and parameters studied.

As outlined in Figs. 1, the cruise track went from Bremerhaven to 60 °N and back south. Unfortunately, there was no phytoplankton bloom in the central or northern North Sea during the time of our cruise, presumably because of nutrient depletion relatively late in the season. We did, however, find a coastal phytoplankton bloom near the northern coast of Denmark where we spent two days before steaming further north (stations 8-11). In order to look for the distribution of the Roseobacter clade also further north and in non-bloom situations, we sampled a transect to 60°N, 3°E and returned to the bloom area at the Danish coast for another four days (stations 17-30). Most stations were sampled repeatedly and in total 36 stations. (for details see Tables on station overview and parameter overview).

Results

The phytoplankton in the entire study area was composed of dinoflagellates, diatoms and Phaeocystis at varying proportions, in and outside the bloom area. The chlorophyll a data indicate a generally decreasing concentration from south to north with the exception of the high concentration at the phytoplankton bloom at the northern coast of Denmark (57.3°N; Fig. 3). The zooplankton was always dominated by copepods but other taxonomic groups such as echinoderm larvae, appendicularians and chaetognaths were also present. Bacterial abundance in near surface waters varied from 0.6 to 1.7 x 10^6 ml^{-1} with highest numbers in the German Bight and little variation further north (Fig. 4a). Bacterial production ranged from 100 to 720 ng C l^{-1} h^{-1} with a general trend of decreasing rates from south to north (Fig. 4b). Turnover rates of glucose varied from 0.2 to 4 per day without a clear-cut trend from south to north (Fig. 4c). The same was true for turnover rates of free amino acids which, however, exhibited rates about one order of magnitude lower (Fig. 4d). The data on the composition of the bacterial communities and the DOM are not yet available because these analyses need much more time.
We also carried out work to enrich and isolate distinct bacterial populations of the Roseobacter clade from the water column and the sediment of various locations. This isolation work is very time consuming because bacteria grow slowly at the very low substrate concentrations we applied. So far, we cannot either say anything about whether these experiments will be successful.

Conclusions and outlook

The field and experimental work on shipboard was very successful, disregarding the fact that we did not find an off shore phytoplan kton bloom in the northern North Sea. The data on phytoplankton, chlorophyll, bacterial abundance and glucose turnover indicate that the various water masses exhibited distinct differences with respect to the biological productivity and activity, being a promising feature to also expect such differences in the community composition of the bacterioplankton.

Acknowledgements:

We are most grateful to the captain and crew of RV Heincke for their excellent support on shipboard, to the Deutsche Forschungsgemeinschaft for financial support and to the responsible authorities of Denmark and Norway for giving us the permission to do research in the economic zones of their countries.

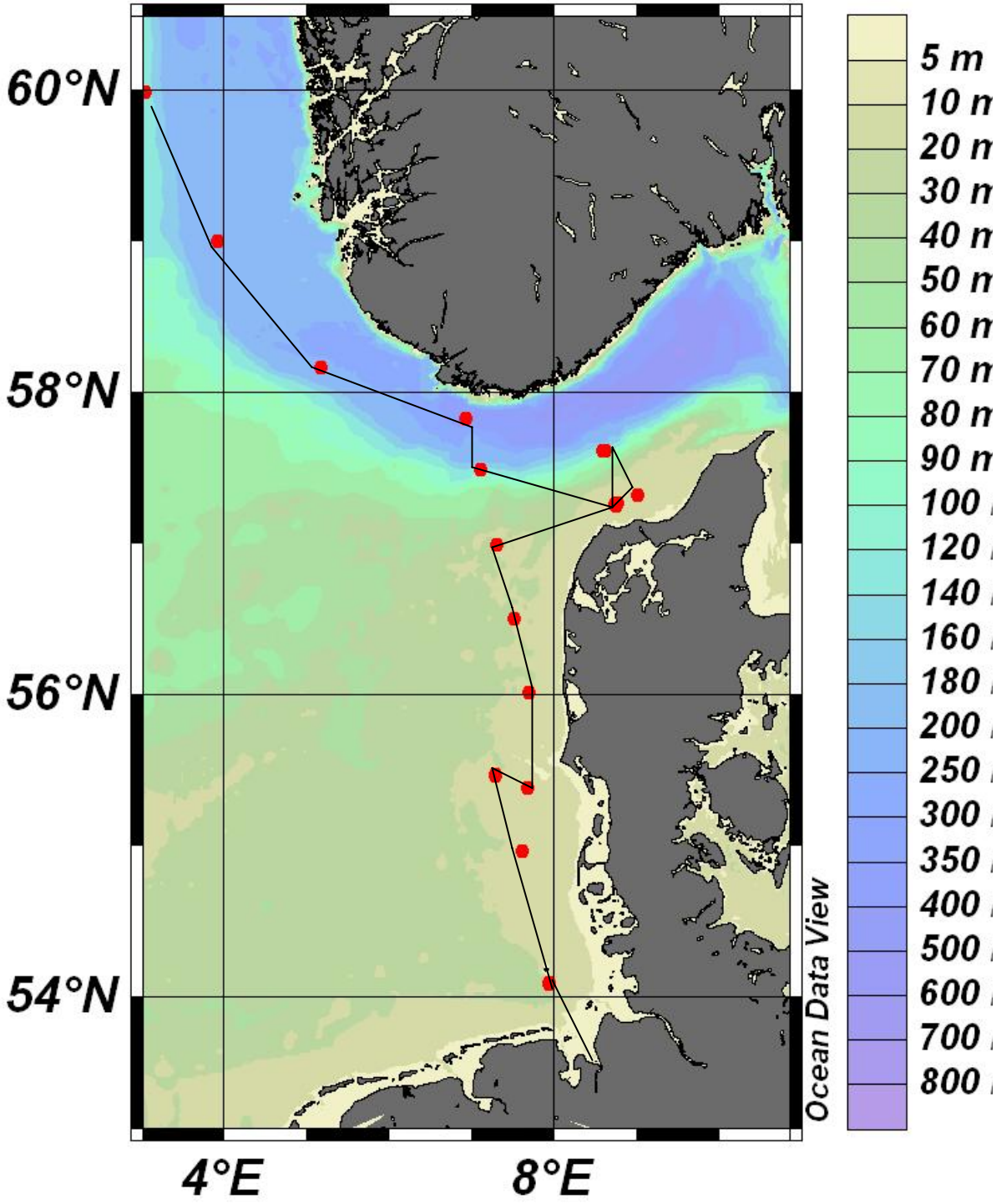

Fig. 1: Cruise track and stations of HE-361. Most of the various stations marked red were visited more than once. For exact location of the stations see Table 1.

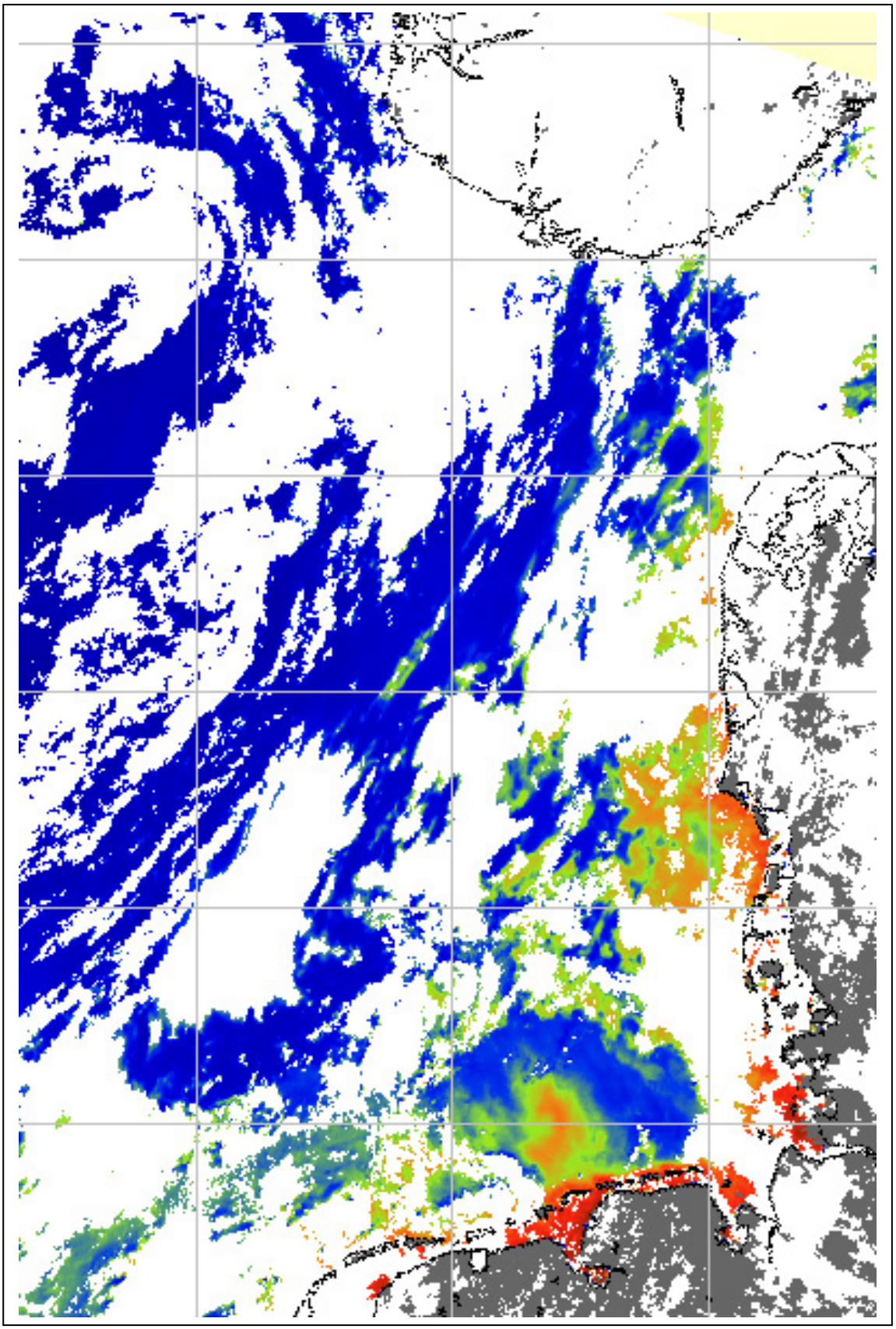

Fig. 2: satellite image of chlorophyll distribution on July 19, 2011 (Courtesy of GKSS)

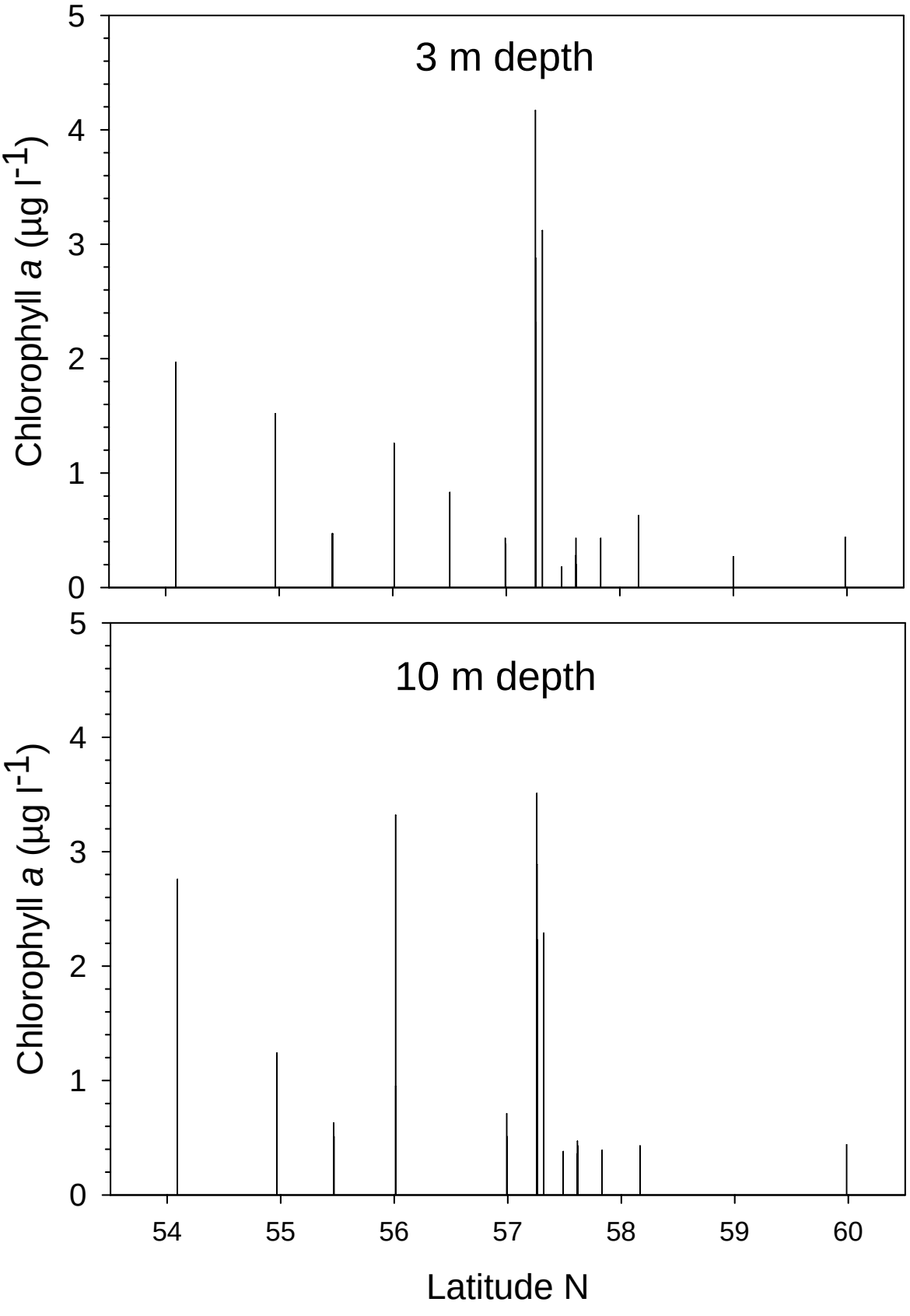

Fig. 3: Chlorophyll *a* at 3 and 10 m depth on a transects (S – N) during cruise HE-361 in the North Sea in July 2011.

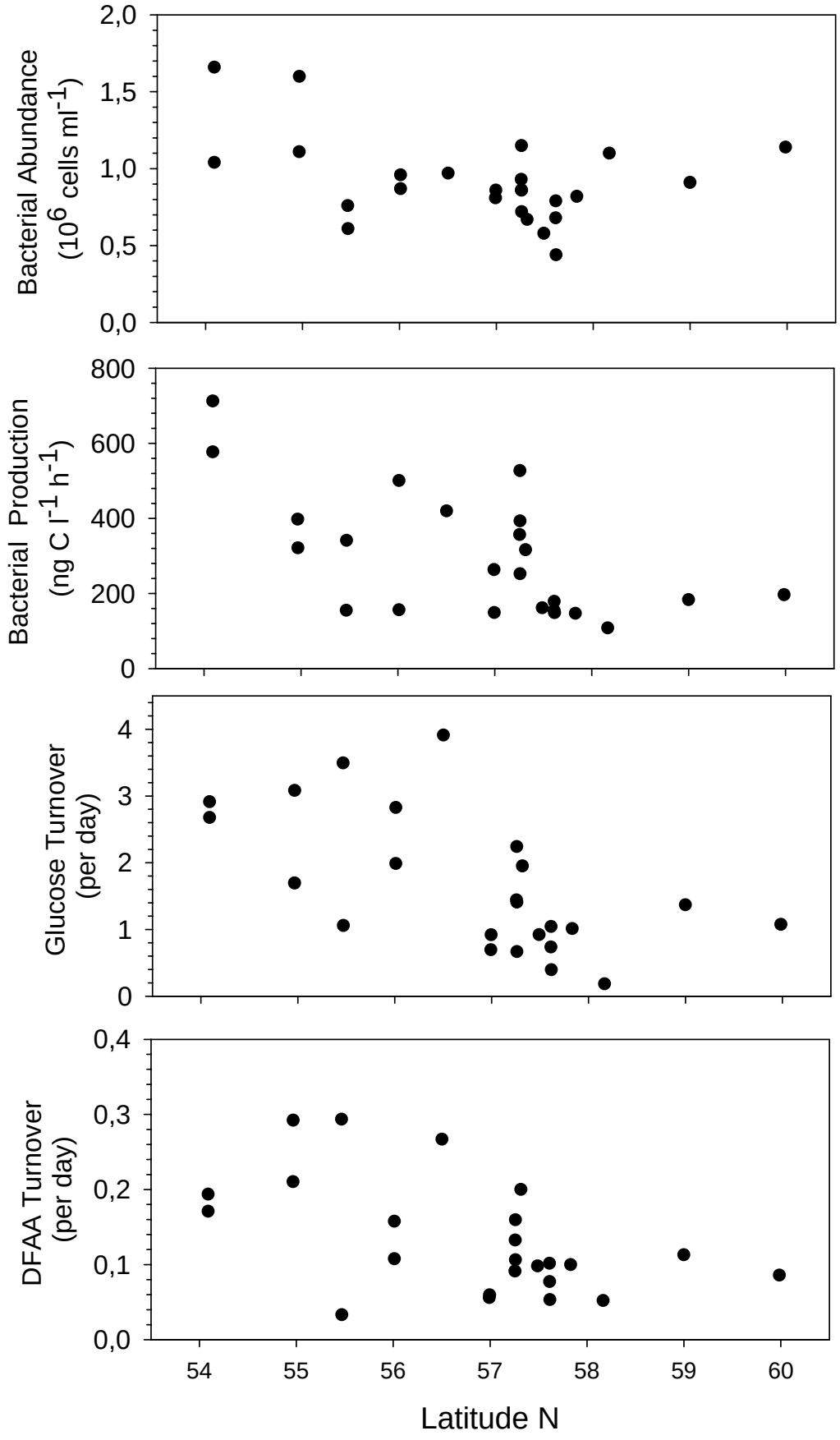

Figure 4: Bacterial abundance (a), production (b), turnover rates of glucose (c) and dissolved free amino acids (DFAA, d) during cruise HE-361 at 3 m depth.

Cruise Heincke-361, 12. - 29. July 2011
Table 1: Station overview

Station	Date	Time (UTC)	Position N	Position E	Temp 0 m (°C)	Depth (max) (m)
1	12.7.	12:24	54° 05.325	7° 56.325	18.4	33
2	15.7.	07:38	54° 57.999	7° 36.359	15.8	22
3	15.7.	12:15	55° 27.977	7° 17.131	14.8	26
4	15.7.	14:46	55° 22.77	7° 40.20	15.7	22
5	16.7.	06:12	56° 00.715	7° 41.412	15.8	27
6	16.7.	10:08	56° 30.105	7° 30.165	15.7	30
7	16.7.	13:56	56° 59.609	7° 17.590	15.2	33
8	17.7.	06:02	57° 15.609	8° 44.010	14.8	24
9	17.7.					
10	18.7.	13:00	57° 19.002	9° 00.310	15.3	24
11	18.7.	06:33	57° 15.470	8° 44.754	15.3	25
12	18.7.	14:41	57° 29.314	7° 06.066	15.5	182
13	19.7.	06:06	57° 49.83	6° 55.11	16,.5	385
14	19.7	13:41	58° 09.940	5° 10.158	14.7	291
15	20.7.	05:58	58° 59.910	3° 55.392	14.6	276
16	20.7.	14:35	59° 59.088	3° 02.160	14.5	120
17	22.7.	11:01	57° 15.402 Diel cycle	8° 44.04	16.5	25
18	22.7.	16:59	57° 15.522 Diel cycle	8° 44.55	16.5	25
19	22.7.	21:02	57° 15.942 Diel cycle	8° 44.328	16.4	25
20	23.7.	22:57	57° 15.252 Diel cycle	8° 44.418	16.4	25
21	23.7.	00:55	57° 15.552 Diel cycle	8° 44.088	16.4	25
22	23.7.	02:58	57° 15.678 Diel cycle	8° 44.82	16.4	25
23	23.7.	05:02	57° 15.492 Diel cycle	8° 44.52	16.4	25
24	23.7.	11:00	57° 15.612 Diel cycle	8° 43.998	16.6	25
25		17:01	57° 15.948 Diel cycle	8° 45.342	16.7	25
26	24.7.	06:04	57° 15.618 Diel cycle	8° 44.52	16.4	25
27	24.7.	10:00	57° 36.768	8° 34.908	16.0	115
28	25.7.	06:02	57° 15.676	8° 44.379	15.9	25
29	25.7.	10:09	57° 36.80	8° 38.122	16.1	112
30	26.7.	06:02	57° 15.668	8° 44.991	16.0	25
31	26.7.	10:03	57° 36.810	8° 36.265	16.3	113
32	26.7.	17:09	56° 59.609	7° 17.590	15.7	23
33	27.7.	05:57	56° 00.388	7° 41.785	16.7	27
34	27.7.	09:59	55° 28.152	7° 17.088	16.3	25
35	27.7.	13:43	54° 57.971	7° 36.222	17.6	23
36	28.7.	10:44	54° 5.412	7° 56.142	17.2	36

Station overview, plankton composition net tows
Heincke 361
12.-29.7. 2011

Station	Day (time, MEST)	Latitude N	Longitude E	Sampling depth water column (m)	Sediment (m)	Phytoplankton net tow	Zooplankton net tow
1	12.7.	54° 05.325	7° 56.325	3, 10 20			
2	15.7.	54° 57.999	7° 36.359	3, 10			
3	15.7.	55° 27.977	7° 17.131	3, 10			
4	15.7.	55° 22.77	7° 40.20		25		
5	16.7.	56° 00.715	7° 41.412	3, 10			
6	16.7.	56° 30.105	7° 30.165	3, 10, 23		Ceratium tripos, C. horridum, C. fusus, C. furca, Phaeocystis globosa	Copepods, Oikopleura, Radiolarians, many Echinoderm larvae
7	16.7.	56° 59.609	7° 17.590	3, 10, 27		Rhizosolenia, Ceratium tripos, C. horridum, C. fusus, C. furca,	Copepods, Oikopleura, Radiolarians, viele Echinoderm larvae
8	17.7.	57° 15.609	8° 44.010	3, 10, 18		Rhizosolenia dominant, also Phaeocystis, C. horridum, C. fusus, C. furca,	Copepods, Radiolarians, Echinoderm larvae
9	17.7.				27	No net tow	
10	18.7.	57° 19.002	9° 00.310	3, 8., 18		Rhizosolenia dominant, also Phaeocystis, C. horridum, C. fusus, C. furca,	
11	18.7.	57° 15.470 Mesocosm	8° 44.754	3, 10		Rhizosolenia, Ceratium tripos, C. horridum, C. fusus,	Copepods, Radiolarians, Echinoderm larvae
12	18.7.	57° 29.314	7° 06.066	3, 10, 25, 60, 100, 150		Rhizosolenia, Ceratium tripos, C. horridum, C. fusus, Protoperidinium	Copepods,
13	19.7.	57° 49.83	6° 55.11	3, 10, 25, 60, 100, 200, 350		Rhizosolenia, Ceratium tripos, C. horridum, C. fusus,	Copepods, Echinoderm larvae, Oikopleura

14	19.7	58° 09.940	5° 10.158	3, 10, 25, 250		
15	20.7.	58° 59.910	3° 55.392	3, 18, 33, 60, 100, 250		
16	20.7.	59° 59.088	3° 02.160	3, 10, 22, 27,060, 100		
17	22.7.	57° 15.402 Diel cycle	8° 44.04	3, 10		
18	22.7. 19:00	57° 15.522 Diel cycle	8° 44.55	3, 10	Rhizosolenia, Phaeocystis, Ceratium tripos, C. fusus, C. furca	Copepods, Chaetognaths, Echinoderm larvae,
19	22.7.	57° 15.942 Diel cycle	8° 44.328	3, 10		
20	23.7. 1:00	57° 15.252 Diel cycle	8° 44.418	3, 10	Rhizosolenia, Phaeocystis, Ceratium tripos, C. fusus, C. furca	Copepods, Chaetognaths, Echinoderm larvae
21	23.7.	57° 15.552 Diel cycle	8° 44.088	3, 10	Rhizosolenia, Phaeocystis, Ceratium tripos, C. fusus, C. furca	Copepods, Chaetognaths, Echinoderm larvae
22	23.7.	57° 15.678 Diel cycle	8° 44.82	3, 10	Rhizosolenia, Phaeocystis, Ceratium tripos, C. fusus, C. furca	Copepods, Chaetognaths, Echinoderm larvae
23	23.7. 7:00	57° 15.492 Diel cycle	8° 44.52	3, 10	Rhizosolenia, Phaeocystis, Ceratium tripos, C. fusus, C. furca	Copepods, Echinoderm larvae
24	23.7. 13:00	57° 15.612 Diel cycle	8° 43.998	3, 10	Rhizosolenia, Phaeocystis, Ceratium tripos, C. fusus, C. furca	Copepods, Fritillaria, Echinoderm larvae, Branchiostoma
25		57° 15.948 Diel cycle	8° 45.342	3, 10		
26	24.7.	57° 15.618 Diel cycle	8° 44.52	3, 10	Long aggregate stringers	many Noctiluca
27	24.7.	57° 36.768	8° 34.908	3,10, 30, 60, 100	Rhizosolenia, Ceratium tripos, C. fusus, C. horridum	Copepods, Oikopleura, Evadne, Echinoderm larvae
28	25.7. 8:00	57° 15.676	8° 44.379	3, 10	Ceratium tripos, C. fusus, few Rhizoseolenia	Copepods, Noctiluca, Echinoderm larvae, Branchiostoma, Evadne

29	25.7. 12:00	57° 36.80	8° 38.122	3, 10, 30, 60, 100		Rhizosolenia, Ceratium tripos, C. fusus, C. furca, C. horridum	Copepods, Oikopleura, Radiolarians with ingested red Synecchococcus, Echinoderm larvae
30	26.7. 8:00	57° 15.668	8° 44.991	3, 10		few Rhizosolenia, Ceratium tripos, C. fusus, C. furca, few C. horridum, several Phaeocystis	Copepods, Noctiluca, Echinoderm larvae, Branchiostoma, Evadne, Chaetognats
31	26.7. 12:00	57° 36.810	8° 36.265	3, 10, 30, 60, 100		Rhizosolenia, Ceratium tripos, C. fusus, C. horridum, Phaeocystis	Copepods, , Radiolarians with ingested red Synechococcus, Echinoderm larvae
32	26.7. 18:00	56° 59.609	7° 17.590	3, 10, 20, 27		Rhizosolenia, Ceratium tripos, C. fusus, C. furca, C. horridum,	Copepods, Echinoderm larvae, Oikopleura, Evadne, Medusae
33	27.7. 8:00	56° 0.388	7° 41.785	3, 16		Rhizosolenia, Ceratium tripos, C. fusus, C. furca,	Copepods, Noctiluca, Oikopleura,
34	27.7. 12:00	55° 28.152	7° 17.088	0, 3, 10, 20		Very few algae	Dense bloom of Noctiluca, Copepods
35	27.7. 16:00	54° 57.971	7° 36.222	3, 10, 20		Ceratium tripos, C. fusus, C. furca, Chaetoceros sp., Bacteriastrum, Coscinodiscus u a.	Dense bloom of Noctiluca, Copepods Quite a few aggregates
36	28.7., 12:45	54° 5.412	7° 56.142	3, 10	21		

Parameter overview water column

Station	Date	POC	Chl	BrDU	DNA	FISH	BP/AA/ Glc	MAR-FISH	Bact	Phyto	DOC	DAA/ DCHO	inorg. nutr	FT-ICR-MS	pH	ROS
1	12.07.	+	+	-	+	+	+	-	+	+	+	+	+	+	+	-
2	15.07..	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
3	15.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
5	16.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
6	16.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
7	16.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
8	17.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
10	17.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
11	18.07.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
12	18.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
13	19.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
14	19.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
15	20.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
16	20.07.	+	+	+	+	-	+	-	+	+	+	+	-	+	+	-
17	22.07.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
18	22.07.	+	+	+	+	-	+	+	+	+	+	-	-	+	-	+
19	22.07.	+	-	-	+	+	-	-	+	+	+	+	-	+	-	+
20	22.07.	+	+	+	+	-	+	-	-	-	+	+	-	+	-	+
21	23.07.	-	-	-	+	+	-	-	+	+	+	-	-	+	-	+
22	23.07.	-	-	-	-	-	-	-	-	-	+	-	-	+	-	+
23	23.07.	+	+	+	+	-	+	-	+	+	+	+	-	+	-	+
24	23.07.	+	+	+	-	-	-	-	-	-	+	+	-	+	-	+
25	23.07.	-	-	-	-	-	-	-	-	-	+	-	-	+	-	+
26	24.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+
27	24.07.	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-
28	25.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
29	29.07.	+	+	-	+	+	+	-	+	+	+	+	+	+	+	-
30	26.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-
31	26.07.	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-

Station	Date	POC	Chl	BrDU	DNA	FISH	BP/AA/ Glc	MAR-FISH	Bact	Phyto	DOC	DAA/ DCHO	inorg. nutr	FT-IC-R-MS	pH	ROS
32	26.07.	+	+	-	+	+	+	-	+	+	+	+	+	+	+	-
33	27.07.	-	+	+	+	+	+	-	+	+	+	+	+	+	+	-
35	27.07.	+	+	-	+	+	+	-	+	+	+	+	+	+	+	-
36	27.07.	+	+	-	+	-	+	-	+	+	+	+	+	+	+	-

Parameter overview sediment

Station	Date	POC	Pore water	Amino acids	TCC	CARD-FISH	Cultivation	DNA
4	15.07.2011	+	+	+	+	+	+	+
5	16.07.2011	+	+	+	+	+	+	+
8	17.07.2011	+	+	+	+	+	+	+
12	18.07.2011	+	+	+	+	+	+	+
13	19.07.2011	+	+	+	+	+	+	+
15	20.07.2011	+	+	+	+	+	+	+
16	20.07.2011	+	+	+	+	+	+	+
27	24.07.2011	+	+	+	+	+	+	+
36	28.07.2011	+	+	+	+	+	+	+

CRUISE SUMMARY REPORT

FOR COLLATIMG CENTRE USE

Centre: **DOD** **Ref. No.:**

Is data exchange restricted ☐ Yes ☐ In part ☐ No

SHIP enter the full name and international radio call sign of the ship from which the data were collected, and indicate the type of ship, for example, research ship; ship of opportunity, naval survey vessel; etc.

Name: **Heincke** **Call Sign:** **HE**

Type of ship: **Research Vessel**

CRUISE NO. / NAME **HE 361**

enter the unique number, name or acronym assigned to the cruise (or cruise leg, if appropriate).

CRUISE PERIOD start **(set sail)** **22/07/2011** **day/ month/ year** to **29/07/2011** **day/ month/ year** end **(return to port)**

PORT OF DEPARTURE (enter name and country) **Bremerhaven, Germany**

PORT OF RETURN (enter name and country) **Bremerhaven, Germany**

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coodinating the scientific planning of the cruise

Name: ICBM, University of Oldenburg

Address: POBox 2503, D-26111 Oldenburg

Country: Germany

CHIEF SCIENTIST(S) enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruise.

Prof. Dr. Meinhard Simon, ICBM, University of Oldenburg

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The Roseobacter clade during phytoplankton blooms in the North Sea

PROJECT (IF APPLICABLE) if the cruise is designated as part of a larger scale cooperative project (or expedition), then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: Collaborative Research Center (CRC, SFB) TRR 51 Roseobacter

Coordinating body: University of Oldenburg

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data collected on the cruise and who may be contacted for further information about the data. (The letter assigned below against each Principal Investigator is used on pages 2 and 3, under the column heading 'PI', to identify the data sets for which he/she is responsible)

Prof. Dr. Meinhard Simon

MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) deployed and/or recovered during the cruise. Separate entries should be made for each location (only deployment positions need be given for drifting systems). This section may also be used to report data collected at fixed locations which are returned to routinely in order to construct 'long time series'.

PI See top of page.	APPROXIMATE POSITION LATITUDE deg	min	N/S	LONGITUDE deg	min	E/W	DATA TYPE enter code(s) from list on cover page.	DESCRIPTION Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, dates of deployments and/or recovery, and any identifiers given to the site.
								Please continue on separate sheet if necessary

SUMMARY OF MEASUREMENTS AND SAMPLES TAKEN

Except for the data already described on page 2 under 'Moorings, Bottom Mounted Gear and Drifting Systems', this section should include a summary of all data collected on the cruise, whether they be measurements (e.g. temperature, salinity values) or samples (e.g. cores, net hauls).

Separate entries should be made for each distinct and coherent set of measurements or samples. Different modes of data collection (e.g. vertical profiles as opposed to underway measurements) should be clearly distinguished, as should measurements/sampling techniques that imply distinctly different accuracy's or spatial/temporal resolutions. Thus, for example, separate entries would be created for i) BT drops, ii) water bottle stations, iii) CTD casts, iv) towed CTD, v) towed undulating CTD profiler, vi) surface water intake measurements, etc.

Each data set entry should start on a new line – it's description may extend over several lines if necessary.

NO, UNITS : for each data set, enter the estimated amount of data collected expressed in terms of the number of 'stations'; miles' of track; 'days' of recording; 'cores' taken; net 'hauls'; balloon 'ascents'; or whatever unit is most appropriate to the data. The amount should be entered under 'NO' and the counting unit should be identified in plain text under 'UNITS'.

PI	NO	UNITS	DATA TYPE	DESCRIPTION
see page 2	see above	see above	Enter code(s) from list on cover page	Identify, as appropriate, the nature of the data and of the instrumentation/sampling gear and list the parameters measured. Include any supplementary information that may be appropriate, e. g. vertical or horizontal profiles, depth horizons, continuous recording or discrete samples, etc. For samples taken for later analysis on shore, an indication should be given of the type of analysis planned, i.e. the purpose for which the samples were taken.
A	**35**	**35**	**H10**	**see cruise track**
A	**35**	**35**	**H24**	**see cruise track**
A	**35**	**35**	**B02**	**see cruise track**
A	**35**	**35**	**B71**	**see cruise track**
A	**35**	**35**	**B03**	**see cruise track**
A	**35**	**35**	**B08**	**see cruise track**
A	**35**	**35**	**B07**	**see cruise track**
A	**35**	**35**	**B72**	**amino acids, see cruise track**
A	**35**	**35**	**B07**	**see cruise track**
				Please continue on separate sheet if necessary

TRACK CHART: You are strongly encouraged to submit, with the completed report, an annotated track chart illustrating the route followed and the points where measurements were taken.	**Insert a tick(✔) in this box if a track chart is supplied** ☒

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data were collected during the cruise – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

North Sea

SPECIFIC AREAS: If the cruise activities were concentrated in a specific area(s) of an ocean or sea, then enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each square in which data were collected from the below given chart

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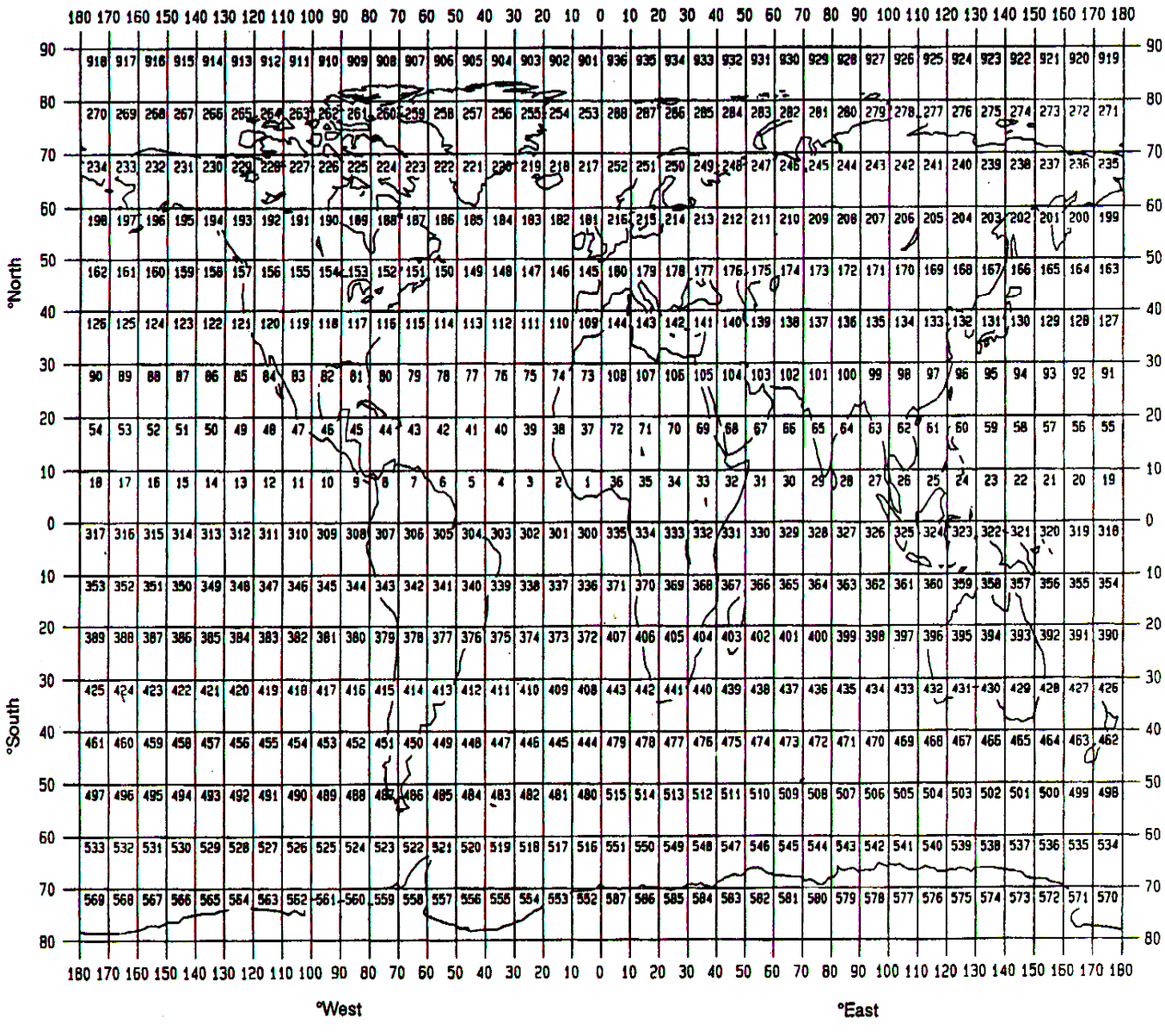
GEOGRAPHIC COVERAGE - INSERT 'X' IN EACH SQUARE IN WHICH DATA WERE COLLECTED

see above



THANK YOU FOR YOUR COOPERATION