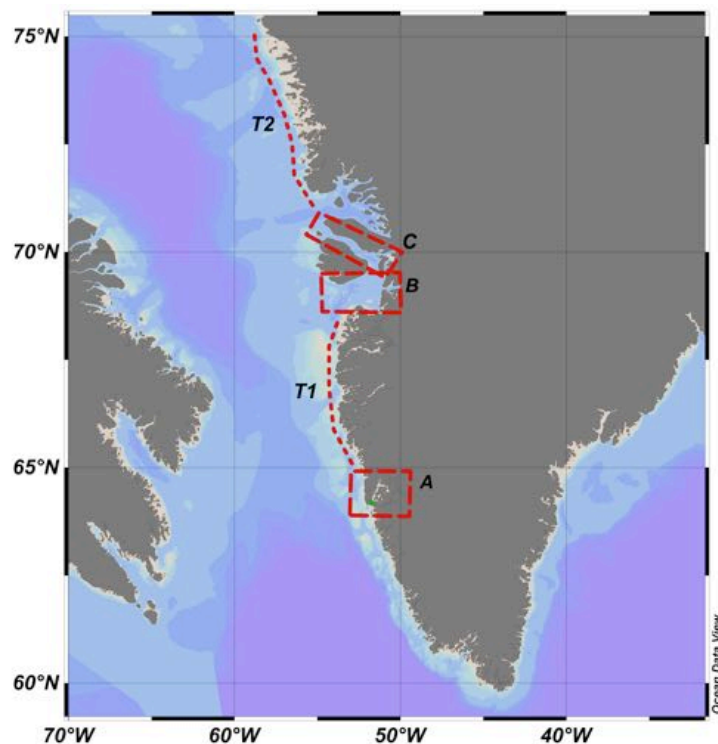


Prof. Dr. Oliver Zielinski  
Institute for Chemistry and Biology  
of the Marine Environment (ICBM)  
University Oldenburg  
Carl-von-Ossietzky-Str. 9-11  
D-26129 Oldenburg  
Tel: +49 441 798 3518  
Fax: +49 441 798 3511  
Email: oliver.zielinski@uol.de



## Short Cruise Report Maria S. Merian MSM65

**St. John's, Canada – Nuuk, Greenland**  
**25. June 2017 – 19. July 2017**  
**Chief Scientist: Oliver Zielinski**  
**Captain: Björn Maaß**



## **Objectives**

Predicted global warming (IPCC 2007) is expected to lead to an increased supply of meltwater from glaciers to fjords and coastal regions along the Greenland coast. To understand the consequences of these changes in the Arctic is one of the most important challenges for Earth Sciences today. Knowledge about the present state of the ecosystems at the western coast of Greenland, however, remains rather limited. Furthermore, the impact of the increased glacier outflow on nutrients, productivity as well as on structure and function of the pelagic and benthic microbial communities has thus far not been addressed.

Proliferation of certain algae in marine or brackish waters can cause massive fish kills, contaminate seafood with toxins, and alter ecosystems in ways that human perceive as harmful. These events are now generally referred to as “harmful algal blooms” (HABs), a recurrent and globally increasing phenomenon causing far-reaching problems for fisheries, aquaculture, recreation and tourism, and ecosystem functioning, as well as for human health. Such algal-related problems are especially acute for coastal regions where many of the toxic events and their effects are most concentrated. Algal toxins have recently been documented in various parts of the Arctic, but both the identity and biogeography of the producing organisms, their population dynamics and the fate of the toxins in the food web remain largely unexplored.

The MSM65 “GreenHAB II” expedition investigated the interactions between hydrography, bio-optics, and planktonic composition (especially toxigenic algae and their toxins) in combination with metagenomic approaches in fjords and embayments of West Greenland as well as along a latitudinal transect along the West Greenland coast. These systems differ in their ice cover, glacial melt water runoffs, and history. The results shall be used to estimate quantifiable effects on the Arctic West Greenland ecosystem, which are driven by an accelerated glacial melt water runoff and climate change.

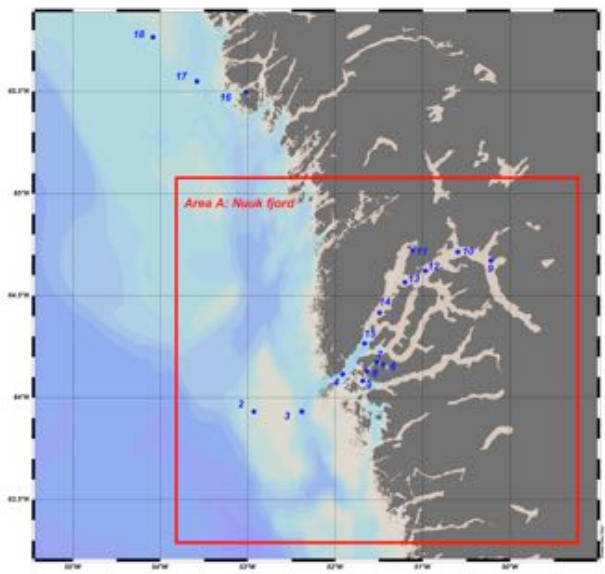
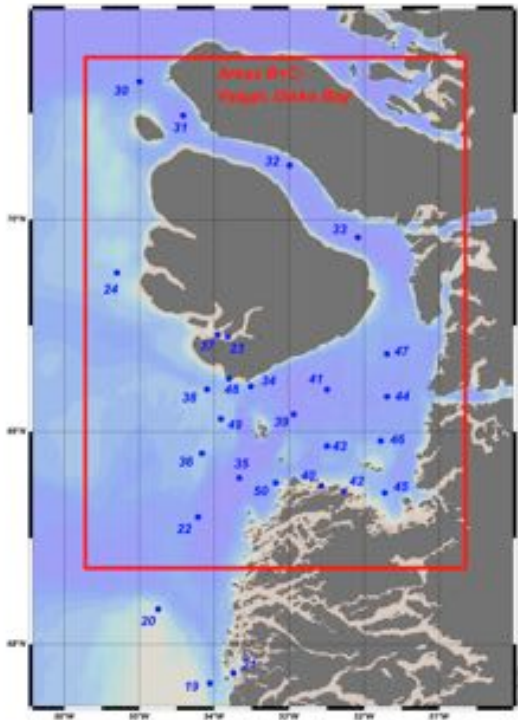
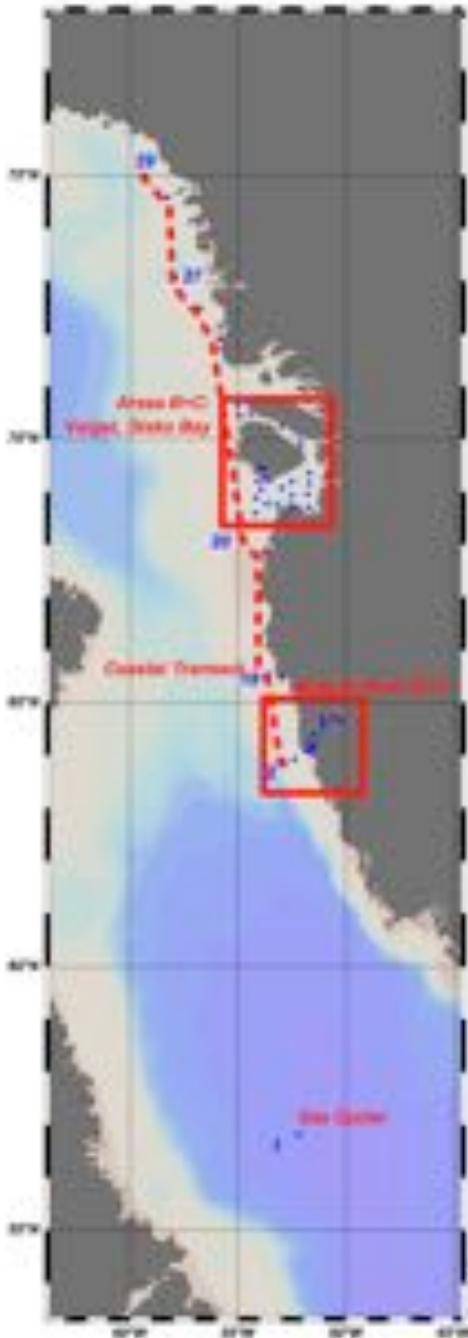
## Narrative

Twenty-two participating scientists from Germany, the United States, Chile and Canada covered a broad expertise in biology, chemistry, oceanography and marine technology. Addressing the objectives of the expedition vertical profiles and water sampling were conducted with respect to standard oceanographic parameters, toxin concentrations, inorganic nutrients, dissolved oxygen concentration, dissolved organic carbon as well as He/Ne gas ratios (to account for basal melt water) through the upper water column. Plankton net tows enabled us to investigate the abundance of harmful key species. To gain further insights in the cyst development of target plankton species, sediment samples were collected applying grabbing and coring methodologies. Metagenomic approaches allowed us to further characterize whole microbial communities with a special emphasis on the phytoplankton and HAB species. We furthermore utilized two advanced bio-optical sensing systems in the upper water column, assessing the distribution of spectral underwater light field and optically active substances. A FerryBox underway system continuously recorded surface water information on temperature, salinity, chlorophyll fluorescence, turbidity and oxygen. Surface drifters were deployed to track water movement over a timespan of up to 4 months.

Maria S. Merian expedition MSM65 started on June 25<sup>th</sup> in the morning from the port of St. John's, Canada. After bunkering fuel and some calibrations of the tracking system, we headed 550 nm northwards to recover the VITALIS-SeaCycler mooring of Dalhousie University, Canada. Recovery of the moorings top part (winch, sensor and telemetry module) and lower part (mooring line with sensors attached) was successful (June 27<sup>th</sup>) and we additionally performed a full CTD cast (June 28<sup>th</sup>) and other gear operations to achieve data for the validation and extension of the time series. Again heading North (430 nm) we reached Fyllas Bank in front of the Nuuk- / Godthåbsfjord (Area A, see map) on June 29<sup>th</sup>. Until July 3<sup>rd</sup> we sampled 14 stations within this area, including a station near the Narssap Sermia melt water glacier. Second we conducted a south-to-north transect between 64°N and 75°N along the West coast of Greenland, sampling 14 stations in different distances to the coast (from inshore to 20 nm of coast), guided by reported findings of toxins and actual satellite maps. Reaching "Point North", we headed 280 nm South entering the Vaigat on July 10<sup>th</sup> in the evening. After a short series of 4 stations, we finally reached our last target area, the Disko Bay on July 12<sup>th</sup>. Performing 17 stations all across the bay, we achieved an unprecedented assessment of harmful algae abundances, toxin distribution and corresponding abiotic conditions in that area. After finishing the 50<sup>th</sup> and final station on July 17<sup>th</sup>, we left the working area and started our transit to Nuuk, Greenland.

In total we sampled 50 stations with 50 CTD water sampler casts, 63 plankton net tows, 43 bio-optical-package profiles, 43 Secchi disk readings, 39 hyperspectral radiometric profiles, 26 Van Veen grabs, 12 MUC (multi-corer) and 22 vibro corer operations. We successfully deployed 8 surface drifters, recovered one mooring and performed two zodiac missions. Underway we sampled 2750 nautical miles of FerryBox and radiometric reflectance data and more than 3000 nautical miles with different echo sounding sensors.

Main study areas of MSM65



## **Acknowledgements**

We like to thank captain Björn Maaß and his entire crew. Their commitment and professional support was key to this successful expedition. We also very much enjoyed the friendly and cooperative atmosphere onboard Maria S. Merian. We are grateful for the excellent support by the Leitstelle Deutsche Forschungsschiffe, Bries Research, the logistics department of the AWI as well as LPL Projects + Logistics GmbH. Furthermore we acknowledge the support and research permits by the Royal Danish Ministry of Foreign Affairs and the collaboration with the Greenland Institute of Natural Resources. We also acknowledge the German embassy in Denmark for their kind support. Financial support and was kindly provided by the Deutsche Forschungsgemeinschaft (DFG), Senatskommission Ozeanographie (MerMet 15-85 Zielinski). Additional financial support was provided through funding from AWI (PACES program), WHOI and ICBM. Part of the work was carried out as part of the Coastal Ocean Darkening project, funded by the Ministry for Science and Culture of Lower Saxony, Germany (VWZN3175).

## List of participants

Last name	First name	Affiliation	Task
Zielinski	Oliver	ICBM	Chief scientist, PI oceanography+bio-optics
Krock	Bernd	AWI	Deputy chief scientist, PI analytical chemistry
Henkel	Rohan	ICBM	Oceanography, deck operations
Voß	Daniela	ICBM	Bio-optics, lab operations, logistics
Meier	Daniela	ICBM	Bio-optics
Tillmann	Urban	AWI	PI eukaryotes
Tillmann	Anette	AWI	Eukaryotes
Anderson	Don	WHOI	PI cysts, sediment operations
Fischer	Alexis	WHOI	Cysts
Trefault	Nicole	UMA	PI metagenomics
Max	Thomas	AWI	Analytical chemistry
Vásquez	Mónica	PUC	Eukaryotes, metagenomics
Siddall	Gregory	DAL	SeaCycler
Rieger	Niclas	UHB	Noble gas tracer
Müller	Annegret	AWI	Analytical chemistry, responsible f. chemicals
Leefmann	Tim	AWI	DOC and nutrients
Cembella	Allan	AWI	PI biological oceanography
Krieger	Erik	AWI	Biological oceanography
D'Entremont	Nicole	WHOI	Sediment cores, echosounding
Braun	Axel	ICBM	Oceanography, deck operations
Mascarenhas	Veloisa	ICBM	Bio-optics
Pieck	Martin	None	Outreach, media

AWI: Alfred Wegener Institut-Helmholtz Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany

DAL: Dalhousie University, Halifax, Canada

ICBM: Institute for Chemistry and Biology of the Marine Environment, University Oldenburg, Germany

PUC: Pontificia Universidad Católica, Santiago, Chile

UHB: University Bremen, Germany

UMA: Universidad Mayor, Santiago, Chile

WHOI: Woods Hole Oceanographic Institution, Woods Hole, MA, USA



### List of stations

#	Name	Timestamp	Latitude	Longitude	Depth	Gear
1	SeaCycler	28.06.17 01:43	56° 49,417' N	052° 13,146' W	3535.7	CTD, PN, CD, RP, D, SC
2	FB2.5	29.06.17 11:50	63° 55,986' N	052° 56,014' W	68.3	CTD, PN, BOP, SD, RP, VC, D
3	FB1	29.06.17 16:25	63° 55,998' N	052° 23,018' W	226.3	CTD, PN, BOP, RP, D
4	GF3	29.06.17 20:06	64° 06,995' N	051° 55,011' W	374.3	CTD, PN, BOP, RP
5	KF1	29.06.17 23:02	64° 05,014' N	051° 41,251' W	216.8	CTD
6	KF4	30.06.17 10:00	64° 09,827' N	051° 27,161' W	147.1	CTD, PN, BOP, SD, RP, VC
7	KF3	30.06.17 14:39	64° 10,498' N	051° 31,763' W	113.7	CTD, PN, BOP, SD, RP, VC
8	KF2	30.06.17 18:27	64° 07,947' N	051° 38,591' W	63.3	CTD, PN, BOP, SD, VC
9	GF13	01.07.17 10:48	64° 40,332' N	050° 13,142' W	431.9	CTD, PN, BOP, SD, Z
10	GF11.5	01.07.17 17:00	64° 42,871' N	050° 35,924' W	518.1	CTD, PN, BOP, SD
11	GFQ1	02.07.17 09:59	64° 43,307' N	051° 06,997' W	141.2	CTD, PN, BOP, SD, RP, VV, MUC
12	GF10	02.07.17 15:03	64° 37,345' N	050° 58,016' W	567.6	CTD, PN, BOP, SD, RP, VV, MUC
13	GF9	02.07.17 20:01	64° 33,994' N	051° 12,196' W	591.6	CTD, PN, BOP, SD, RP
14	GF7	03.07.17 10:02	64° 25,012' N	051° 29,767' W	612.9	CTD, PN, BOP, SD, RP
15	GF5	03.07.17 14:03	64° 16,003' N	051° 39,901' W	348.2	CTD, PN, BOP, SD, RP
16	MA1	04.07.17 10:02	65° 29,822' N	053° 01,540' W	129.6	CTD, PN, BOP, SD, RP, VV, MUC, VC
17	MA2	04.07.17 15:08	65° 33,005' N	053° 35,001' W	154.6	CTD, PN, BOP, SD, RP
18	MA3	04.07.17 19:00	65° 45,999' N	054° 04,997' W	96.8	CTD, PN, BOP, SD, RP
19	AT2	05.07.17 10:02	67° 49,006' N	054° 03,504' W	124,1	CTD, PN, BOP, SD, RP, VV, D
20	AT3	05.07.17 15:37	68° 10,008' N	054° 45,005' W	47,9	CTD, PN, BOP, SD, RP, VV, D
21	AT1	06.07.17 10:34	67° 51,922' N	053° 44,913' W	139,5	CTD, PN, BOP, SD, RP, VV, MUC, VC
22	DB1	06.07.17 18:49	68° 36,005' N	054° 13,025' W	415,9	CTD, PN, BOP, SD, RP, D
23	DF1	07.07.17 10:01	69° 26,913' N	053° 49,214' W	78	CTD, PN, BOP, SD, RP, VV, MUC, VC
24	DF2	07.07.17 17:47	69° 44,989' N	055° 17,889' W	90,4	CTD, PN, BOP, SD, RP
25	SK1	08.07.17 10:02	71° 55,540' N	055° 53,000' W	255,4	CTD, PN, BOP, SD, RP, VV
26	SK2	08.07.17 16:37	72° 29,986' N	056° 45,000' W	222,3	CTD, PN, BOP, SD, RP, VV
27	SK3	08.07.17 21:54	73° 03,748' N	057° 53,390' W	510,9	CTD, PN, VV
28	MB1	09.07.17 09:56	74° 35,024' N	058° 15,588' W	214,4	CTD, PN, BOP, SD, VV
29	MB2	09.07.17 15:46	75° 00,033' N	059° 17,413' W	515,1	CTD, PN, BOP, SD, RP, VV
30	VG0	10.07.17 20:00	70° 39,000' N	055° 00,004' W	430,3	CTD, PN
31	VG1	11.07.17 09:47	70° 29,425' N	054° 24,904' W	488,3	CTD, PN, BOP, SD, RP, VV, MUC
32	VG2	11.07.17 15:37	70° 15,276' N	052° 59,833' W	395,8	CTD, PN, BOP, SD, RP
33	VG3	11.07.17 20:29	69° 54,941' N	052° 05,117' W	546,9	CTD, PN, BOP, SD, RP, VV
34	DB2	12.07.17 09:27	69° 12,906' N	053° 30,992' W	181,6	CTD, PN, BOP, SD, RP, VV, MUC
35	DB3	12.07.17 15:49	68° 47,012' N	053° 39,990' W	910,1	CTD, PN, BOP, SD, RP
36	DB4	12.07.17 19:21	68° 53,989' N	054° 09,954' W	121,5	CTD, PN, BOP, SD, RP, VV
37	DF1	13.07.17 10:54	69° 27,505' N	053° 57,149' W	162,9	CTD, PN, MUC, VC

38	DB5	13.07.17 14:01	69° 12,017' N	054° 05,924' W	162,9	CTD, PN, BOP, SD, RP
39	DB6	13.07.17 17:49	69° 04,994' N	052° 56,513' W	456,7	CTD, PN, BOP, SD, RP
40	DB7	14.07.17 09:52	68° 44,754' N	052° 34,566' W	153,7	CTD, PN, BOP, SD, RP, VV, MUC, VC, D
41	DB8	14.07.17 16:08	69° 12,004' N	052° 29,942' W	520,2	CTD, PN, BOP, SD, RP
42	DB10	15.07.17 10:02	68° 43,193' N	052° 16,464' W	119,9	CTD, PN, BOP, SD, RP, VV, MUC, VC
43	DB11	15.07.17 13:43	68° 56,012' N	052° 29,989' W	322	CTD, PN, SD, RP
44	DB12	15.07.17 17:25	69° 10,008' N	051° 41,967' W	263,9	CTD, PN, BOP, SD, RP
45	DB13	16.07.17 09:26	68° 42,829' N	051° 43,777' W	231,7	CTD, PN, BOP, SD, RP, VV, MUC, D, Z
46	DB14	16.07.17 14:53	68° 57,447' N	051° 46,946' W	275,1	CTD, PN, BOP, SD, RP
47	DB9	16.07.17 18:38	69° 22,004' N	051° 41,971' W	341,2	CTD, PN, BOP, SD, RP
48	DB15	17.07.17 09:40	69° 15,043' N	053° 48,443' W	61,6	CTD, PN, BOP, SD, VV, VC
49	DB16	17.07.17 11:56	69° 03,696' N	053° 54,658' W	140,8	CTD, PN, BOP, SD, RP
50	DB17	17.07.17 15:35	68° 45,627' N	053° 10,986' W	338,8	CTD, PN, BOP, SD, VV

Note: Values represent the first recording at each station. Time in UTC. Depth in meters.

Gear coding:

CTD: CTD with giant water sampler rosette  
 PN: Plankton net  
 BOP: Bio-optical package  
 RP: Radiometric profiler (hyperspectral)  
 SD: Secchi disk  
 MUC: Multi Corer  
 VV: Van Veen grabber  
 VC: Vibro Corer  
 D: Drifter (deployment)  
 SC: SeaCycler (recovery)  
 Z: Zodiac operation