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Short Cruise Report RV SONNE, cruise SO286

Emden, Germany - Las Palmas, Spain 05.11.2021 - 08.12.2021 Chief Scientist: Saskia Brix Co-Chief Scientist: James Taylor Captain: Tilo Birnbaum



Figure 1: Map showing the cruise track of RV SONNE cruise SO286. The Stations are the Working Areas.

Objectives

IceDivA2 (*Icelandic marine Animals meets Diversity along latitudinal gradients in the deep sea of the Atlantic Ocean* 2) aimed to investigate the connectivity/biodiversity within key groups of the marine benthic abyssal habitats and their overlaying planktonic communities. IceDivA2 built on the previous work completed during the first IceDivA expedition during January 2021 east of the Mid-Atlantic Ridge (MAR), an expedition connecting the IceAGE (Icelandic marine Animals: Genetics and Ecology) and DIVA (Latitudinal Gradients in BioDIVersity in the deep Atlantic) projects. Coinciding perfectly with the beginning of the UN Ocean Decade at the start of 2021, the IceDivA project has been a proud contributor as part of the Challenger 150 program. IceDivA2 also hosted the Satellite event "A floating classroom: Deep-sea science in action towards a clean ocean" for the UN Ocean Decade's Laboratory on 'A Clean Ocean' on 18th November 2021. This event was conducted live, via satellite, in the middle of the Atlantic Ocean.

A short description of the hypotheses we set out to test are as follows:

- 1. Are there differences in species composition and diversity across a latitudinal transect of the IceDivA2 stations?
- 2. Are there differences in species composition and diversity Atlanticwide?
- 3. Are the observed species restricted to the Atlantic deep-sea abyssal plains?
- 4. How does species composition and diversity vary with depth?
- 5. How are populations genetically connected within IceDivA2?
- 6. Are molecular taxonomic methods able to reveal cryptic diversity in North Atlantic deep-sea fauna?

Narrative

Starting in Emden, Germany, SO286 has been the last expedition according to the Pandemic call for German research vessels with quarantine rules prior to the cruise and limited scientist numbers allowed on board. We arrived at the RV SONNE in Emden on the 4th of November, after following all the current Covid-19 regulations, with all 27 scientists and 33 crew members testing negative via PCR test 48 hours before boarding the vessel. On the 4th, preceding our departure on the 5th we were able to set up and secure all laboratories and workstations, including two genetic labs, two sorting labs, and a photography station, for sample processing on board, as well as securing all our heavy gear.

Due to the testing nature of trying to conduct marine research in the North Atlantic during the winter months, we were pushed to the extreme as we faced storm after storm attempting to cross the North Atlantic. Thankfully, due to the nature of our research questions and operating in international waters, we had the freedom to adapt the position of our research locations to find 3-4 days' worth of good weather window as long as we located abyssal plain areas deeper than 3000m. This flexibility ultimately allowed us to complete 3.5 workstations out of the proposed five, despite station work being unable for the first 15 days.

As previously stated, we were battered by extreme poor weather, having to bunker down twice during our western transit across the Atlantic, once of the coast of the Faroe Islands and once off the North coast of Iceland. This route North of Iceland was necessary as waves of up to 14 m and winds up to 11 Beaufort pose a real danger on our original rout crossing the North Atlantic South of Iceland. We refused to let this time be wasted, however. With such an eclectic mix of knowledge on board we hosted a daily seminar series in which everybody presented previous work they had accomplished or what they were contributing on board. With a large student contingent this served as both practice in presenting, and horizon broadening from senior scientists. We also used the time to organize and prepare the pre-recorded material for our UN Ocean Decade satellite event.

During week 3 on board, on Wednesday 17th November the core event of the UN Ocean Decade's Laboratory on 'A Clean Ocean' was held in Berlin with the RV SONNE playing host to our satellite event the following day. This really marked the turning point of our expedition, particularly in terms of weather. Even at sea we needed a dress rehearsal to ensure the smooth production of our live event, divided between the Senckenberg Museum in Frankfurt and the RV SONNE.

Following the satellite event, the 19th of November, we were full steam ahead with the scientific program. Our first working area, that we achieved (our original work area 2) was in the Labrador Basin. This was our first opportunity to deploy a full quota of scientific gear, which included: CTD, EM122 Multibeam Surveying, Ocean Floor Observation System (OFOS), Bongo Net, Multinet, WP2 Net, Epibenthic Sledge (EBS), Large Box Corer (GKG), Neuston Catamaran, Multiple Corer (MUC), and Agassiz Trawl. We would go on to perform a full deployment of all gears at two further locations during week 4 (28th November 2021) and week 5 (5th December 2021), west of the Charlie-Gibbs Fracture and at the final possibility west of the MAR at 37°N. For our final station we attempted to sample a nearby flat-topped seamount from work area 3, however our good weather window closed, allowing only for the deployment of the TV-MUC and EBS.

Paramount prior to deploying our gear was the mapping of the seafloor using the ship-board EM122 Multibeam system, which in itself gave us two highlights in the mapping of an underwater mountain range. The use of this allowed safe deployment of the benthic gear to soft bottom sediment, and especially for the deployment of the OFOS, which were in all working areas live streamed and live commented via the MARUM server and YouTube.

In the last week, we were using time on the transit to Las Palmas to add Neuston catamaran stations at wish positions from our colleagues of the PLASTISEA project (Erik Borchert, GEOMAR) based on what they had sampled during SO279 December 2020 and us with SO280 in January 2021. The last catamaran deployment was on the 6th of December.

During the final transit to Las Palmas, Spain, on the 7th and 8th December, we were able to do sample sorting and management, prepare the logistics, and clean the labs for their next users. On the evening of December 8th 2021, RV SONNE entered port having been extremely lucky with wind and currents towards the Canary Islands. In the afternoon of the 9th December 2021, the scientific party left RV SONNE with many successful samples.



Figure 2: The scientific team on board of RV SONNE during IceDivA2. From left to right (back row): Vivien Lukas Hartmann, Karen Jeskulke, Nicole Gatzemeier, Sahar Khodami, Elham Kamyab, Mia Schumacher, James Taylor, Angelina Eichsteller, Katrin Linse, Frederik Bonk, Kevin Kess, Lisa Gaertner, Pedro Martinez, Denisse Galarza Verkovitch, Saskia Brix; from left to right (front row): Stefanie Kaiser, Franziska Theising, Alexander Kieneke, Anne-Nina Lörz, Tjardo Stoffers, Severin Korfhage, Tim Bierschenk, Maik Wilsenack, Anna Krug, Marco Bruhn, Jenny Neuhaus (Picture taking and not in view: Viola Siegler).

Acknowledgements

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Scientific Party

1.	Brix, Saskia PhD	Fa	hrtleiter / Chief Scientist	SaM
2.	Taylor, James PhD	Co	-Fahrtleiter / Co-Chief Scientist	SaM
3.	Martinez Arbizu, Pedro Prof.	Ma	arine Biology / MUC	SaM
4.	Kieneke, Alexander PhD	Ma	arine Biology / MUC	SaM
5.	Khodami, Sahar PhD	Ma	arine Biology / MUC	SaM
6.	Linse, Katrin PhD	Ma	arine Biology / EBS	BAS
7.	Bonk, Frederik	Ma	arine Biology / EBS	COUO/SaM
8.	Stoffers, Tjardo Ole	Ma	arine Biology / CTD & MSN	COUO/SaM
9.	Schumacher, Mia	Ba	thymetry / BC	GEOMAR
10.	Hartmann, Vivien Lukas	Ma	asterstudent / CTD & BC	UHH/SaM
11.	Jeskulke, Karen	Te	chnician / Database	SaM
12.	Gatzemeier, Nicole	Te	chnician / MSN & Plankton	SaM
13.	Wilsenack, Maik	Te	chnician / EBS	SaM
14.	Korhage, Severin	Ma	asterstudent / MUC	COUO/SaM
15.	Theising, Franziska	Ma	asterstudent Macrofauna	CAU/SaM
16.	Neuhaus, Jenny	Ph	D student Macrofauna/iAtlantic	SaM
17.	Keß, Kevin	Ma	asterstudent Bathymetry	GEOMAR
18.	Bruhn, Marco	Te	chnician BC / MUC	SaM
19.	Siegler, Viola	Te	chnician teleprensence	SaM
20.	Eichsteller, Angelina	Ph	D student / AGT	SaM
21.	Gaertner, Lisa	Ma	asterstudent marine litter	UR/SaM
22.	Kamyab, Elham	Ma	arine Biology / iAtlantic	SaM
23.	Krug, Anna	Ma	asterstudent	UHH/SaM
24.	Lörz, Anne-Nina	Ma	arine Biology	UHH
25.	Kaiser, Stefanie	Ma	arine Biology	ULodz
26.	Bierschenk, Tim	Ma	arine Biology	COUO/SaM
27.	Galarza Verkovitch, Denisse	Ma	asterstudent marine litter	GEOMAR

SaM - Senckenberg am Meer,

Deutsches Zentrum für Marine Biodiversitätsforschung (DZMB), Wilhelmshaven, Germany

GEOMAR - Helmholtz-Zentrum für Ozeanforschung Kiel, Germany

BAS - British Antarctic Survey, Cambridge, England

UHH - Universität Hamburg, Biocenter Grindel, Hamburg, Germany

COUO - Carl von Ossietzky Universität Oldenburg, Germany

ULODZ - Universität Łódź, Poland

UR - Universität Rostock, Germany

Station List

Station No.	Date	Gear	Time (UTC)	Latitude	Longitude	Water depth	Remarks
SO286_1-1	18.11.2021	CTD	21:50	58° 00.576' N	054° 09.097' W	3415	
SO286_2-1	19.11.2021	MB	00:39	58° 00.565' N	054° 09.158' W	3419	
SO286_3-1	19.11.2021	BC	21:48	58° 12.979' N	054° 13.514' W	3386	
SO286_4-1	22.11.2021	BC	00:27	58° 12.964' N	054° 13.508' W	3387	
SO286_5-1	20.11.2021	BC	02:43	58° 12.934' N	054° 13.486' W	3382	
SO286_6-1	20.11.2021	EBS	05:21	58° 12.905' N	054° 13.462' W	3386	
SO286_7-1	20.11.2021	EBS	10:05	58° 11.588' N	054° 13.278' W	3389	
SO286_8-1	20.11.2021	MUC	15:24	58° 12.918' N	054° 13.601' W	3386	
SO286_9-1	20.11.2021	MUC	17:37	58° 12.922' N	054° 13.601' W	3385	
SO286_10-1	20.11.2021	MSN	20:19	58° 12.829' N	054° 13.603' W	3385	
SO286_11-1	20.11.2021	MSN	20:41	58° 12.449' N	054° 13.511' W	3390	
SO286_12-1	21.11.2021	WP2	01:08	58° 05.799' N	054° 11.608' N	3408	
SO286_13-1	21.11.2021	Bongo Net	01:56	58° 05.680' N	054° 11.620' W	3413,5	
SO286_14-1	21.11.2021	Bongo Net	02:37	58° 04.300' N	054° 11.643' W	3416,8	
SO286_15-1	21.11.2021	Bongo Net	03:13	58° 03.054' N	054° 11.632' W	3432,6	
SO286_16-1	21.11.2021	Bongo Net	03:52	58° 01.483' N	054° 11.625' W	3421,6	
SO286_17-1	21.12.2021	CTD	04:45	58° 00.320' N	054° 11.615' W	3413	
SO286_18-1	21.11.2021	MSN	06:01	57° 59.309' N	054° 11.112' W	3411	
SO286_19-1	21.11.2021	AGT	12:17	58° 12.289' N	054° 13.409' W	3387	
SO286_20-1	21.11.2021	EBS	17:58	58° 12.028' N	054° 13.308' W	3387	
SO286_21-1	21.11.2021	MUC	21:23	58° 14.422' N	054° 13.075' W	3391	
SO286_22-1	22.11.2021	MUC	00:03	58° 11.375' N	054° 13.096' W	3390	
SO286_23-1	22.11.2021	Catamaran	02:57	58° 11.379' N	054° 13.136' W	3389	
SO286_24-1	22.11.2021	Catamaran	03:25	58° 12.086' N	054° 15.015' W	3385	
SO286_25-1	22.11.2021	Catamaran	03:47	58° 12.719' N	054° 16.694' W	3385	
SO286_26-1	22.11.2021	Catamaran	04:18	58° 13.418' N	054° 18.570' W	3381	
SO286_27-1	22.11.2021	OFOS	09:18	58° 12.990' N	054° 13.530' W	3387	
SO286_28-1	24.11.2021	CTD	12:40	52° 08.490' N	039° 04.370' W	3540	
SO286_29-1	24.11.2021	Multibeam	15:30	52° 08.466' N	039° 04.349' W	3544	
SO286_30-1	25.11.2021	MSN	13:17	52° 08.360' N	039° 04.314' W	3547	
SO286_31-1	25.11.2021	WP2	15:14	52° 05.507' N	039° 01.711' W	3674	
SO286_32-1	25.11.2021	CTD	15:41	52° 05.513' N	039° 01.693' W	3676	
SO286_32-1	25.11.2021	CTD	15:41	52° 05.513' N	039° 01.693' W	3675	
SO286_33-1	25.11.2021	Bongo Net	16:22	52° 05.516' N	039° 01.670' W	3674	
SO286_34-1	25.11.2021	Bongo Net	16:50	52° 04.663' N	039° 00.881' W	3712	
SO286_35-1	25.11.2021	Bongo Net	17:27	52° 03.879' N	039° 00.149' W	3654	
SO286_36-1	25.11.2021	Bongo Net	18:04	52° 02.721' N	038° 59.197' W	3654	
SO286_37-1	25.11.2021	MSN	18:49	52° 01.657' N	038° 58.284' W	3639	
SO286_38-1	26.11.2021	OFOS	00:48	52° 01.120' N	038° 49.180' W	2354	
SO286_39-1	26.11.2021	OFOS	08:38	51° 58.260' N	038° 59.660' W	3689	
SO286_40-1	26.11.2021	Catamaran	13:35	51° 56.905' N	038° 59.179' W	3642	

SO286_41-1	26.11.2021	Catamaran	14:06	51° 55.280' N	038° 59.123' W	3642	
SO286_42-1	26.11.2021	MUC	15:30	51° 58.255' N	038° 59.534' W	3685	
SO286_43-1	26.11.2021	MUC	19:03	51° 28.263' N	038° 59.506' W	3685	
SO286_44-1	26.11.2021	BC	21:44	51° 58.265' N	038° 59.498' W	3685	
SO286_45-1	27.11.2021	BC	00:19	51° 58.258' N	038° 59.482' W	3686	
SO286_46-1	27.11.2021	EBS	02:55	51° 57.600' N	038° 59.375' W	3677	
SO286_47-1	27.11.2021	MUC	07:58	51° 57.454' N	038° 59.325' W	3675	
SO286_48-1	30.11.2021	CTD	12:10	37° 37.306' N	035° 31.146' W	3280	
SO286_49-1	30.11.2021	Multibeam	14:42	37° 37.266' N	035° 31.163' W	3304	
SO286_50-1	01.12.2021	OFOS	17:10	37° 00.040' N	035° 29.580' W	3194	
SO286_51-1	01.12.2021	MSN	23:15	36° 58.286' N	035° 28.621' W	2855	
SO286_52-1	02.12.2021	WP2	01:26	36° 55.656' N	035° 26.771' W	2881	
SO286_53-1	02.12.2021	CTD	02:12	36° 55.655' N	035° 26.775' W	2879	
SO286_54-1	02.12.2021	Bongo Net	02:39	36° 55.570' N	035° 26.714' W	2884	
SO286_55-1	02.12.2021	Bongo Net	03:08	36° 54.941' N	035° 26.317' W	2927	
SO286_56-1	02.12.2021	Bongo Net	03:43	36° 54.394' N	035° 25.971' W	2957	
SO286_57-1	02.12.2021	Bongo Net	04:09	36° 53.886' N	035° 25.664' W	2920	
SO286_58-1	02.12.2021	MSN	04:50	36° 53.079' N	035° 25.287' W	2800	
SO286_59-1	02.12.2021	OFOS	09:52	37° 07.380' N	035° 17.510' W	2053	
SO286_60-1	02.12.2021	EBS	16:05	36° 59.408' N	035° 29.208' W	3179	
SO286_61-1	02.12.2021	BC	20:52	36° 59.243' N	035° 29.128' W	3167	
SO286_62-1	02.12.2021	BC	23:55	37° 00.022' N	035° 29.498' W	3192	
SO286_63-1	03.12.2021	BC	02:04	37° 00.021' N	035° 29.486' W	3191	
SO286_64-1	03.12.2021	EBS	04:20	36° 59.428' N	035° 29.176' W	3180	
SO286_65-1	03.12.2021	MUC	09:41	37° 00.025' N	035° 29.491' W	3193	with camera
SO286_66-1	03.12.2021	MUC	12:28	37° 00.032' N	035° 29.441' W	3193	with camera
SO286_67-1	03.12.2021	MUC	15:17	37° 00.037' N	035° 29.382' W	3192	with camera
SO286_68-1	03.12.2021	Catamaran	18:50	37° 00.042' N	035° 29.386' W	3191	
SO286_69-1	03.12.2021	Catamaran	19:13	36° 58.802' N	035° 28.798' W	3075	
SO286_70-1	03.12.2021	Catamaran	19:48	36° 57.707' N	035° 28.208' W	3043	
SO286_71-1	03.12.2021	Catamaran	20:15	36° 56.587' N	035° 27.644' W	2894	
SO286_72-1	03.12.2021	AGT	22:02	37° 00.045' N	035° 29.462' W	3107	
SO286_73-1	04.12.2021	BC	02:44	36° 59.296' N	035° 29.172' W	3178	
SO286_74-1	04.12.2021	BC	05:01	36° 59.284' N	035° 29.148' W	3174	
SO286_75-1	04.12.2021	MUC	08:51	37° 13.922' N	035° 32.316' W	2508	with camera
SO286_76-1	04.12.2021	EBS	11:47	37° 13.551' N	035° 32.276' W	2530	
SO286_77-1	05.12.2021	Catamaran	07:58	35° 21.698' N	031° 17.179' W	3228	
SO286_78-1	05.12.2021	Catamaran	05:25	35° 21.157' N	031° 15.918' W	3250	
SO286_79-1	07.12.2021	Catamaran	15:43	32° 07.600' N	023° 51.400' W	5422	
SO286_80-1	06.12.2021	Catamaran	16:21	32° 07.608' N	023° 49.700' W	5425	