

Saskia Brix & James Taylor
Senckenberg am Meer, Deutsches Zentrum für Marine Biodiversitätsforschung

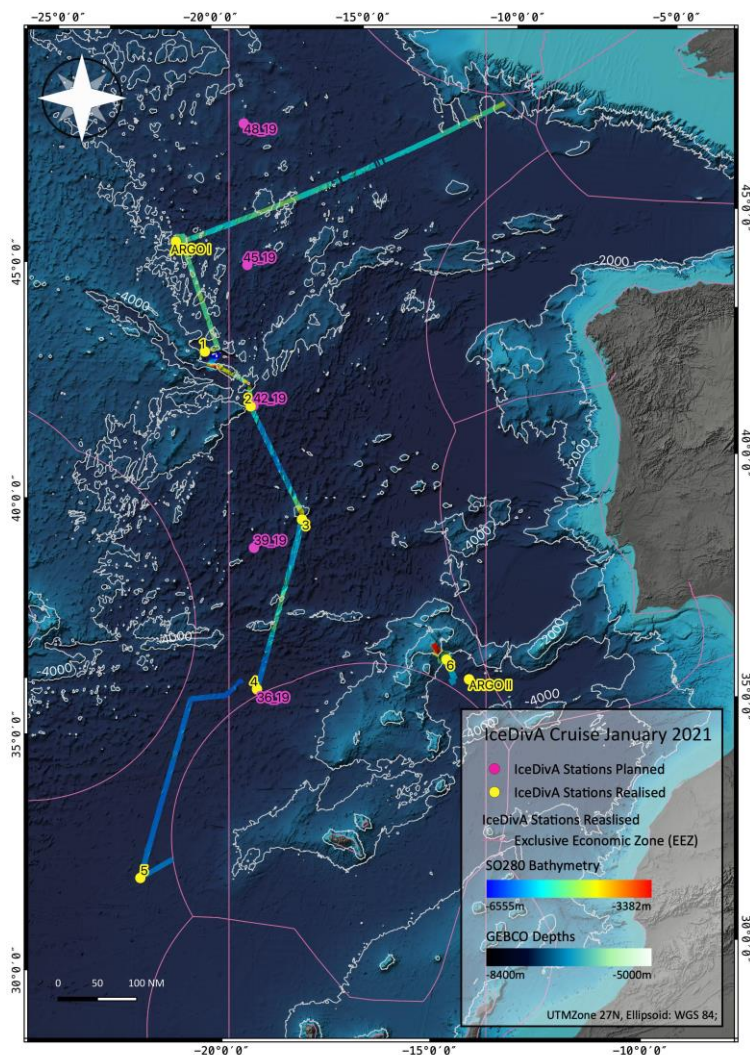
c/o Biocenter Grindel
Martin-Luther-King-Platz 3
20146 Hamburg

Tel.: 040 42838 5642
email: sbrix@senckenberg.de

Short Cruise Report

R/V SONNE, cruise SO280 (GPF 20-3_087)

Emden – Emden (Germany)
08.01.2021 – 07.02.2021
Chief Scientist: Saskia Brix
Co-Chief Scientist: James Taylor
Captain: Lutz Mallon



Objectives

The North Atlantic is the target region of this expedition, to be more precise, the north-east Atlantic deep-sea areas off the spreading axis of the Mid-Atlantic Ridge (MAR) in water depth below 4,000m. Our focus on the east side of the MAR links the Icelandic Basin, the Western European basin and the Porcupine Basin with the deep-sea basins South of the Azores and the Horseshow Basin as comparison areas located behind a seamount chain, acting as a potential distribution barrier for the deep-sea fauna. Connectivity and distribution of species in the deep sea of the North Atlantic is strongly linked to bathymetry and oceanography data. With little in terms of previous bathymetry east of the MAR we were aiming to enhance bathymetry knowledge for the 19-22°W profile along with the IceDivA stations. Our work area started at 45° N with an oceanographic station (ARGO swarm only) and ended in a zigzag line at the Southern end at 32°N. We could sample five working areas defined in 5x5 nm grids. The northernmost station on 45°N being a solely oceanographic station, with full biological stations taking place at 42°N, 36°N, and 32°N. The main objective is to compare the selected deep-sea stations along the latitudinal transect with respect to composition and diversity of the targeted benthic and planktonic taxa. The faunistic (morphological and genetic) data shall be related to the achieved environmental data (i.e. measured abiotic and biotic variables) of the corresponding stations.

The following five hypotheses were approached:

H1₀: The four sampled stations along the latitudinal transect present no differences with respect to the species composition and diversity of the benthic and planktonic taxa under study; a faunistic gradient that follows the latitudinal one cannot be detected.

H1_A: The five sampled stations differ regarding the composition and diversity of the studied benthic and planktonic species; a faunistic gradient accompanying the latitudinal one is clearly discernible.

H2₀: The species found at the five stations show a wide geographic distribution in the Atlantic Ocean; neither submarine ridges nor seamounts form any kind of barrier for the dispersal of species.

H2_A: A restriction of the geographical dispersal is detectable; submarine elevations may constitute barriers for the distribution of species.

H3₀: The species found at the five stations are eurybathic and also occur in shallow-water biotopes of seamounts, oceanic is-lands and continental coasts.

H3_A: The species found at the five stations are restricted to the Atlantic deep-sea abyssal plains.

H4₀: The diversity of species decreases with depth, reflecting habitat homogeneity, including little variation in temperature and constant darkness in the deep sea.

H4_A: No depth-related gradient in species diversity can be detected.

H5₀: Geographic populations of species distributed across the five sampled areas along the latitudinal transect are genetically homogeneous.

H5_A: There is a clear geographic structuring of intraspecific genetic diversity along the latitudinal transect (e.g. 'isolation by distance').

Alongside the biological work aboard, SO280 hosted the "DArgo2025_RBRpilot" project. The objective of this oceanographic project is to conduct testing of major seagoing scientific instrumentation and to provide necessary reference data for the evaluation. In order to test the accuracy and stability of the inductive CTDs (RBRargo³) a small fleet of floats is deployed together. A total of 10 floats were designated for deployment, equally divided between floats carrying an RBRargo3 CTD and those carrying a SBE41 CTD. The float deployments support the core Argo network and were carried out in a low-density area of floats.

Narrative

Starting and ending in Emden (Germany), SO280 (GPF 20-3_087) has been an expedition according to the Pandemic call for German research vessels with quarantine rules prior to the cruise, single cabin use, and limited scientist numbers allowed on board. Before entering the vessel, crew and scientists were tested negative for the corona virus. On January 6 2021 everybody was allowed on board after the "testcamp" in the hotel Ostfriesenhof (Leer, Germany). Due to the expected weather conditions, January 7 was a harbor day used for unpacking the containers and preparing the laboratories before leaving Emden early morning on the 8th January. The transit days were spent in scientific meetings to organise responsibilities within gear teams and the safety muster drill.

We arrived at position of our first work station (45.50' N, 21'W) on Tuesday, January 12 at 9.30am, where the first reference CTD and 10 ARGO floats were deployed in a 48 hours continuous station. After the final CTD we began underway multibeam mapping to the next station at 42° N, 19° W. This position is originally Work Area 3 (WA3 = 42-19) in our cruise proposal, however unrelenting stormy conditions in our first two WAs meant this decision was unavoidable.

On the morning of Friday, January 15 we arrived at WA 3 (42-19), with a CTD for bathymetric calibration, and eDNA filtration beginning directly at 8.50am. We then performed a 5x5 nm bathymetric mapping exercise in order to deem suitability for gear deployment. In the afternoon we began the "plankton block" of gear deployment, under clean ship conditions, seeing successful deployments of the Multinet, Plankton net, Bongo net, and Neuston Catamaran. In the early hours of Saturday morning we deployed the Ocean Floor Observation System (OFOS) and the rest of Saturday and Sunday was spent successfully deploying two Epibenthic Sledges, three Giant Box Corers, and three Multicorers in our "benthos block" of gear. The same working procedure was conducted in each WA.

On Sunday, January 17 we started a ~30 hour transit to WA 5 (36-19). All other WAs were to be hit with prolonged, stormy weather, making our planned work infeasible there. On Tuesday, January 19 at 6:00 p.m. we reached WA5 (36-19) and started with a deep CTD down to 20m above ground and benthic mapping. Due to the weather conditions, the "plankton block" was pushed behind the "benthos block", as the strong winds would cause issues for the nets. Weather conditions, especially the swell, also caused difficulties with the benthic gear. Overall, everyone turned out to be a solution-oriented team member, so that we were able to successfully bring samples on board with all devices. Therefore, we were busy at 36° N until the afternoon of January 22, 2021 (Friday) and then proceeded South at 4:00 p.m.

Wind and waves had already reached 36° N, meaning that now any work under our original plan was not possible. It was therefore inevitable to move to more southerly regions. Here, once more, everyone pulled together and in joint consultation of the scientific program, and strategic weather chess moves by the captain, we calculated a new route to 32° N, which secured two more deep stations for us, as long as current weather predictions held. On the evening of Saturday, January 23, we started with the CTD at 32° N, with the OFOS running overnight. The "plankton block" occurring Sunday morning, followed by the benthos block. A full station lasted approximately 4 days and thus on Monday and Tuesday of the fourth week we were still fully occupied with our station work at 32° N and were able to complete a third full deep-sea station along our latitudinal gradient.

Also after the station work at 32°N, the northern working areas above 36°N continued to be impractical with regards to weather conditions. According to the weather forecast, we needed to change our sampling strategy again. Going further South would have meant too long transit back to Emden and no chance for a full fourth deep station. As there are deep-sea basins outside the storm front, we decided to go as far North as possible but outside of the storm front. We did seek protection in the small strip of international water on the edge of the EEZs of Madeira and Portugal. Separated by a chain of seamounts, including "Josephine" and "Erik", the "horseshoe basin" with a depth of up to 4,800m is where we found ourselves. Our study goals include not only latitudinal gradients, but also geographical barriers between the deep-sea basins, which is a central question in the EU project iAtlantic and our neighbouring projects, IceAGE and DIVA. In addition, the work in the horseshoe basin complements the sampling of the seamounts that took place during MAPS project (Madeiran Archipelago Pre-Seamount Stages).

On Thursday January 28, around 6:00 p.m., we reached our final work area in the horseshoe basin and started with a deep CTD down to 20m above ground, enabling the best resolution

for bathymetry. While the seamounts "Josephine" and "Erik", are in international waters, in a MPA area declared according to OSPAR, we started our station work outside the declared area. All gear was successful, in optimal weather conditions, and the station was successfully completed on January, 31st.

On the way back to the Emden we travelled via the seamount "Josephine" in order to use the remaining time to map this previously unmapped seamount, whilst also using the last of the good weather to pack away all heavy gear into the containers. Work in the laboratories continued during the fifth week inside the ship until February 4.

During the one-week transit to Emden, we were able to do sample sorting and management, prepare the logistics, and clean the labs for their next users. On the evening of February 6 R/V SONNE entered the port of Emden having been extremely lucky with wind and currents passing the English Channel. In the morning of February 7, the scientific party left R/V SONNE with many successful samples.



Figure1: The scientific IceDivA Team in a sunny moment entering the English Channel on the way back to Emden. From left to right – back row: Mia Schumacher, James Taylor, Frederik Bonk, Eileen Deeken, Alexander Kieneke, Franziska Iwan, Vivien Hartmann, Corinna Jensen, Tjardo Stoffers, Simon Tewes. – middle right: Julia Jacoby & Rebecca Mensing. – front row: Sven Hoffmann, Maik Wilsenack, Pedro Martinez, Kai George, Karen Jeskulke, Sahar Khodami, Saskia Brix, Nicole Gatzemeier, Katrin Linse.

Acknowledgements

We would like to thank a whole host of people and departments, without who we simply could not have made this expedition. First and foremost we would like to thank the crew and captain Lutz Mallon for all their support and share what was a special final voyage for Captain Mallon. We are very appreciative of all the hard work and support from Briese, Leitstelle, GPF, BMBF and DFG, making this expedition possible. A special thanks goes to the DWD for guiding our way with daily updated weather predictions. We would like to show our gratitude to Hotel Ostfriesenhof for making our testcamp-stay as comfortable as possible. Finally, we thank our public outreach team (Vikki Gunn - iAtlantic, Viola Siegler & Pressestelle Senckenberg) for telling our tale.

Participant List

1. Brix, Saskia PhD	Fahrtleiter / <i>Chief Scientist</i>	SaM
2. Taylor, James PhD	Co-Fahrtleiter / <i>Co-Chief Scientist</i>	SaM
3. George, Kai Horst PhD	Marine Biology / MUC	SaM
4. Martinez Arbizu, Pedro Prof.	Marine Biology / MUC	SaM
5. Kieneke, Alexander PhD	Marine Biology / MUC	SaM
6. Khodami, Sahar PhD	Marine Biology / MUC	SaM
7. Linse, Katrin PhD	Marine Biology / EBS	BAS
8. Deeken, Eileen	Marine Biology / EBS	COUO
9. Bonk, Frederik	Marine Biology / EBS	COUO
10. Jacoby, Julia	Biological Oceanography & CTD	COUO
11. Stoffers, Tjardo Ole	Marine Biology / CTD & MSN	COUO
12. Schumacher, Mia	Bathymetry / BC	GEOMAR
13. Mensing, Rebecca	Bathymetry /BC	GEOMAR
14. Tewes, Simon	Oceanography	BSH
15. Jensen, Corinna	Oceanography	BSH
16. Hartmann, Vivien Lukas	Biological Oceanography & BC	UHH
17. Jeskulke, Karen	Technician / Database	SaM
18. Gatzemeier, Nicole	Technician / MSN & Plankton	SaM
19. Iwan, Franziska	Technician / Plankton & database	SaM
20. Wilsenack, Maik	Technician / EBS	SaM
21. Hoffmann, Sven	Technician / Neuston & BC	SaM

SaM – Senckenberg am Meer

Deutsches Zentrum für Marine Biodiversitätsforschung (DZMB)
Südstrand 44
26382 Wilhelmshaven / Germany

GEOMAR - Helmholtz-Zentrum für Ozeanforschung Kiel
Wischhofstr. 1-3
24148 Kiel

BSH - Bundesamts für Seeschifffahrt und -Hydrographie
Bernhard-Nocht-Straße 78
20359 Hamburg

BAS - British Antarctic Survey
High Cross,
Madingley Road, Cambridge /England

UHH - University of Hamburg
Biocenter Grindel
Martin-Luther-King-Platz 3
20146 Hamburg

COUO - Carl von Ossietzky Universität Oldenburg
Ammerländer Heerstraße 114-118
26129 Oldenburg

Stationslist

Station	Gear	Date	Time (UTC)	Latitude	Longitude	Water depth	Valid
SO 280-1-1	CTD	12.01.2021	09:18	45° 29.996' N	020° 59.993' W	4103	Yes
SO 280-2-1	Argo Float	12.01.2021	12:42	45° 29.993' N	020° 59.999' W	4098	Yes
SO 280-3-1	CTD	12.01.2021	13:54	45° 37.191' N	020° 52.801' W	4194	Yes
SO 280-4-1	CTD	12.01.2021	17:03	45° 37.209' N	021° 07.217' W	4024	Yes
SO 280-5-1	CTD	12.01.2021	23:03	45° 22.796' N	021° 07.201' W	3909	Yes
SO 280-6-1	CTD	13.01.2021	02:00	45° 22.799' N	020° 52.790' W	4115	Yes
SO 280-7-1	CTD	13.01.2021	07:02	45° 37.194' N	020° 52.801' W	4197	Yes
SO 280-8-1	CTD	13.01.2021	10:19	45° 37.205' N	021° 07.210' W	4014	Yes
SO 280-9-1	CTD	13.01.2021	15:10	45° 22.806' N	021° 07.204' W	3908	Yes
SO 280-10-1	CTD	13.01.2021	18:10	45° 22.836' N	020° 52.809' W	4122	Yes
SO 280-11-1	MB	14.01.2021	08:30	43° 11.306' N	019° 54.111' W	4849	Yes
SO 280-12-1	CTD	15.01.2021	08:57	41° 59.995' N	018° 59.585' W	4845	Yes
SO 280-13-1	MB	15.01.2021	13:39	42° 01.894' N	019° 03.365' W	4607	Yes
SO 280-14-1	Multinet	15.01.2021	15:31	41° 58.201' N	019° 03.777' W	6000	Yes
SO 280-15-1	PLA	15.01.2021	21:37	41° 47.984' N	019° 15.177' W	5735	Yes
SO 280-16-1	PLA	15.01.2021	22:06	41° 47.944' N	019° 15.166' W	4348	Yes
SO 280-17-1	Bongo Net	15.01.2021	22:36	41° 47.916' N	019° 15.211' W	5598	Yes
SO 280-18-1	OFOS	16.01.2021	01:00	41° 57.540' N	018° 58.840' W	4903	No
SO 280-19-1	Bongo Net	16.01.2021	05:33	41° 57.509' N	018° 58.850' W	4903	Yes
SO 280-20-1	Catamaran	16.01.2021	05:50	41° 56.798' N	018° 59.846' W	4904	Yes
SO 280-21-1	EBS	16.01.2021	06:58	41° 57.599' N	018° 58.832' W	4802	Yes
SO 280-22-1	BC	16.01.2021	15:15	41° 57.554' N	018° 58.837' W	4902	Yes
SO 280-23-1	BC	16.01.2021	18:00	41° 57.537' N	018° 58.868' W	4904	Yes
SO 280-24-1	BC	16.01.2021	21:15	41° 57.564' N	018° 58.866' W	4903	Yes
SO 280-25-1	MUC	17.01.2021	01:46	41° 57.546' N	018° 58.781' W	4902	Yes
SO 280-26-1	MUC	17.01.2021	05:08	41° 57.540' N	018° 58.787' W	4904	Yes
SO 280-27-1	MUC	17.01.2021	09:02	41° 57.553' N	018° 58.777' W	4905	Yes
SO 280-28-1	EBS	17.01.2021	12:41	41° 57.554' N	018° 58.768' W	4904	Yes
SO 280-29-1	MUC	17.01.2021	19:47	41° 57.570' N	018° 58.823' W	4906	Yes
SO 280-30-1	MUC	17.01.2021	23:11	41° 57.565' N	018° 58.790' W	4904	Yes
SO 280-31-1	CTD	19.01.2021	13:30	36° 00.004' N	019° 00.000' W	5420	Yes
SO 280-32-1	MB	19.01.2021	18:50	36° 02.759' N	019° 02.132' W	5492	Yes
SO 280-33-1	BC	19.01.2021	19:57	36° 00.006' N	019° 00.003' W	5432	Yes
SO 280-34-1	BC	20.01.2021	23:38	36° 00.000' N	018° 59.968' W	5430	Yes
SO 280-35-1	BC	20.01.2021	03:16	36° 00.003' N	018° 59.950' W	5432	Yes
SO 280-36-1	MUC	20.01.2021	08:05	36° 00.004' N	018° 59.932' W	5432	No
SO 280-37-1	MUC	20.01.2021	11:31	36° 00.001' N	018° 59.944' W	5426	No
SO 280-38-1	MUC	20.01.2021	14:41	36° 00.008' N	018° 59.962' W	5431	No
SO 280-39-1	EBS	20.01.2021	19:03	36° 02.367' N	018° 59.499' W	5488	No
SO 280-40-1	EBS	21.01.2021	02:39	36° 02.328' N	018° 59.497' W	5484	Yes

SO 280-41-1	MUC	21.01.2021	08:27	36° 02.059' N	019° 00.799' W	5485	Yes
SO 280-42-1	MUC	21.01.2021	12:01	36° 02.055' N	019° 00.816' W	5485	Yes
SO 280-43-1	MUC	21.01.2021	15:36	36° 02.057' N	019° 00.832' W	5485	Yes
SO 280-44-1	Bongo Net	21.01.2021	20:25	36° 02.351' N	018° 59.585' W	5490	Yes
SO 280-45-1	OFOS	21.01.2021	21:45	36° 02.328' N	018° 59.519' W	5486	Yes
SO 280-46-1	Bongo Net	22.01.2021	04:51	36° 02.471' N	019° 01.398' W	5492	Yes
SO 280-47-1	PLA	22.01.2021	05:45	36° 02.929' N	019° 02.616' W	5493	Yes
SO 280-48-1	PLA	22.01.2021	06:12	36° 02.929' N	019° 02.617' W	5496	Yes
SO 280-49-1	Multinet	22.01.2021	06:56	36° 02.957' N	019° 02.712' W	5494	Yes
SO 280-50-1	Catamaran	22.01.2021	12:04	36° 09.743' N	019° 25.221' W	5474	Yes
SO 280-51-1	Argo Float	22.01.2021	14:27	36° 10.463' N	019° 26.266' W	5480	Yes
SO 280-52-1	CTD	23.01.2021	14:17	32° 00.002' N	022° 00.005' W	5110	Yes
SO 280-53-1	MB	23.01.2021	19:06	32° 02.307' N	022° 02.072' W	5116	Yes
SO 280-54-1	Bongo Net	23.01.2021	21:12	31° 59.994' N	022° 00.004' W	5107	Yes
SO 280-55-1	PLA	23.01.2021	22:00	32° 00.824' N	022° 01.116' W	5119	Yes
SO 280-56-1	PLA	23.01.2021	22:28	32° 00.828' N	022° 01.117' W	5118	Yes
SO 280-57-1	Bongo Net	23.01.2021	23:21	32° 02.021' N	022° 00.697' W	5121	Yes
SO 280-58-1	OFOS	24.01.2021	00:36	32° 02.047' N	022° 00.695' W	5141	Yes
SO 280-59-1	Multinet	24.01.2021	07:49	32° 03.353' N	022° 01.689' W	5117	Yes
SO 280-60-1	Catamaran	24.01.2021	12:35	32° 12.150' N	022° 16.128' W	5178	Yes
SO 280-61-1	EBS	24.01.2021	15:51	32° 02.025' N	022° 00.652' W	5121	Yes
SO 280-62-1	BC	24.01.2021	21:40	32° 03.187' N	022° 01.513' W	5129	Yes
SO 280-63-1	BC	25.01.2021	00:52	32° 03.194' N	022° 01.533' W	5128	Yes
SO 280-64-1	BC	25.01.2021	04:29	32° 01.969' N	022° 00.700' W	5119	Yes
SO 280-65-1	MUC	25.01.2021	09:05	32° 01.985' N	022° 00.700' W	5122	Yes
SO 280-66-1	MUC	25.01.2021	12:23	32° 01.989' N	022° 00.711' W	5121	Yes
SO 280-67-1	MUC	25.01.2021	15:41	32° 02.002' N	022° 00.726' W	5121	Yes
SO 280-68-1	EBS	25.01.2021	19:16	32° 02.587' N	022° 01.870' W	5125	No
SO 280-69-1	MUC	26.01.2021	02:26	31° 59.996' N	021° 59.999' W	5108	Yes
SO 280-70-1	MUC	26.01.2021	05:45	31° 59.984' N	021° 59.980' W	5105	Yes
SO 280-71-1	Argo Float	27.01.2021	19:09	35° 59.999' N	013° 50.011' W	4794	Yes
SO 280-72-1	CTD	27.01.2021	21:32	36° 26.003' N	014° 00.003' W	4168	Yes
SO 280-73-1	MB	28.01.2021	02:02	36° 33.183' N	013° 55.270' W	3833	Yes
SO 280-74-1	Bongo Net	28.01.2021	06:18	36° 31.390' N	014° 10.028' W	3114	Yes
SO 280-75-1	PLA	28.01.2021	10:19	36° 28.823' N	014° 03.074' W	4075	Yes
SO 280-76-1	PLA	28.01.2021	10:43	36° 28.808' N	014° 03.074' W	4077	Yes
SO 280-77-1	Multinet	28.01.2021	11:20	36° 28.836' N	014° 03.177' W		Yes
SO 280-78-1	Catamaran	28.01.2021	15:30	36° 35.607' N	014° 18.992' W	1806	Yes
SO 280-79-1	MUC	28.01.2021	18:53	36° 26.006' N	014° 00.004' W	4165	Yes
SO 280-80-1	MUC	28.01.2021	21:41	36° 26.006' N	014° 00.025' W	4163	Yes
SO 280-81-1	EBS	28.01.2021	00:55	36° 28.794' N	013° 59.471' W	4165	Yes
SO 280-82-1	BC	29.01.2021	06:10	36° 26.040' N	140° 00.000' W	4164	Yes
SO 280-83-1	BC	29.01.2021	08:55	36° 26.024' N	014° 00.000' W	4164	Yes

SO 280-84-1	BC	29.01.2021	11:35	36° 26.018' N	014° 00.000' W	4167	Yes
SO 280-85-1	EBS	29.01.2021	15:53	36° 28.803' N	013° 59.617' W	4155	Yes
SO 280-86-1	MUC	29.01.2021	21:58	36° 25.997' N	013° 59.998' W	4166	Yes
SO 280-87-1	MUC	30.01.2021	00:44	36° 25.979' N	014° 00.001' W	4169	Yes
SO 280-88-1	MUC	30.01.2021	03:33	36° 25.966' N	014° 00.007' W	4170	Yes
SO 280-89-1	Bongo Net	30.01.2021	06:48	36° 25.219' N	014° 01.013' W	4168	Yes
SO 280-91-1	OFOS	30.01.2021	08:56	36° 25.940' N	013° 59.823' W	4172	Yes
SO 280-93-1	MUC	30.01.2021	17:55	36° 38.004' N	014° 13.999' W	193	Yes
SO 280-94-1	MUC	30.01.2021	18:29	36° 38.003' N	014° 13.999' W	190	Yes
SO 280-95-1	MB	30.01.2021	19:40	36° 33.223' N	014° 15.314' W	1712	Yes