

MapGES 2021 Cruise Report: Exploration and mapping of deep-sea biodiversity in the Azores, summer 2021

MapGES & iAtlantic Project

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Summary report

Main objective

MapGES 2021 is the continuation of our long-term strategy to map deep-sea biodiversity and identify Vulnerable Marine Ecosystems (VMEs) in the Azores using the Azor drift-cam video system. This year, we operated on the RV Arquipélago and on the FV Gotimar, based in the small island of Corvo. Due to an ongoing strike declared by the crew of the RV Arquipélago, our work focused in areas close to Faial harbor (mostly Faial, Pico and São Jorge islands). Using the FV Gotimar, we sampled the slopes of Corvo island for the first time ever. As in other MapGES cruises, the objectives were to (i) map the benthic communities inhabiting unexplored seamounts, ridges and island slopes, (ii) identify new areas that fit the FAO definition of what constitutes a Vulnerable Marine Ecosystem (VME); and (iii) determine the distribution patterns of deep-sea benthic biodiversity in the Azores region. The results of this cruise, when added to other contributions, will help to identify what are the main environmental drivers that determine the spatial distribution of deep-sea benthic fauna in the Azores. This cruise also provided valuable information in the context of Good Environmental Status (GES), Marine Spatial Planning (MSP) and provided new insights on how to sustainably manage deep-sea ecosystems.

Methodology

We performed several underwater video transects along the seafloor with the Azor drift-cam, a low-cost drifting camera system designed and developed at IMAR & Okeanos (University of the Azores). It allows the recording of high-quality underwater video images of the seabed down to 1000 m depth. The system was deployed from the research vessel RV Arquipélago, owned by the Government of the Azores and from the Fishing Vessel Gotimar, owned by Mestre Pereira.

Scientific team

Leg 1: Telmo Morato (chief scientist), Sérgio Gomes, Luís Rodrigues, Manuela Ramos, Guilherme Gonçalves, Gerald H. Taranto

Leg 2: Telmo Morato and Carlos Dominguez-Carrió (chief scientists), Sérgio Gomes, Luís Rodrigues, Gerald H. Taranto, Manuela Ramos

Leg 3: Carlos Dominguez-Carrió (chief scientist), Sérgio Gomes, Luís Rodrigues, Gerald H. Taranto, Guilherme Gonçalves

Cruise summary

The MapGES 2021 survey was divided in 3 legs, which were planned to explore the island slopes of Faial, Pico and São Jorge in central Azores, and Corvo island in the western group (Table 1, Figure 1). Overall, 147 dives (out of 155 stations) were accomplished in 17 sampling areas, which include the slopes of 4 different islands (Table 2). During **Leg 1**, from 15th to 23rd July 2021, we performed 61 dives (out of 64 stations) with the Azor drift-cam, covering 31 km of the seafloor and producing 61 hours of video footage. This leg surveyed the deep-sea benthic communities of the slopes of Faial and Pico islands on board RV Arquipélago. During **Leg 2**, from 10th to 16th August 2021, we performed 18 dives (out of 20 stations) with the Azor drift-cam, covering 8 km of the seafloor and producing 20 hours of video footage. In this leg, we surveyed the slopes around Corvo island for the first time, on board the FV Gotimar. In **Leg 3**, which lasted from the 25th of August to 15th September 2021, we performed 68 dives (out of 71 stations) with the Azor drift-cam, covering 48 km of the seafloor and producing about 68 hours of video footage. Leg 3 explored the benthic communities on the slopes of Faial, Pico and São Jorge Islands on board RV Arquipélago.

Main achievements:

1. During the MapGES 2021 cruise we completed almost 150 underwater video transects between 100 and 970 m depth with the Azor drift-cam, adding up to around 150 new hours of underwater video footage of seabed habitats. As in previous years, the **presence of many lost fishing lines made our deep-sea exploration challenging**. After having the Azor drift-cam caught on several lines, we managed to get free on all occasions with only minor damage. These collateral fishing impacts, which limit the acquisition of deep-sea biodiversity data to inform management, deserve to be better quantified.
2. We completed **the first visual survey of the slopes of Corvo island**, with a total of 18 successful dives with the Azor drift-cam on board of a local fishing vessel, at depths between 130 and 970 m, covering the whole perimeter of the island. The slopes of Corvo island were mostly covered by soft sediments with some basaltic outcrops. In most areas explored, the octocorals *Viminella flagellum* and *Acanthogorgia* sp. formed large aggregations together with the demosponge *Phakellia ventilabrum*. Sporadically, and still within these gardens, we also observed small colonies of the fan-shaped octocoral *Dentomuricea* aff. *meteor* and the “bubblegum” coral *Paragorgia johnsoni*. The black coral *Elatopathes abietina* was also found on most of the dives, forming large but scattered aggregations, while the species *Stichopathes gravieri*, *Parantipathes hironelle* and *Leiopathes glaberrima* were occasionally present.

3. The **island slopes around Faial island** were mostly covered by soft sedimented and deposits of coral rubble at the base of the slopes, with marine snow visible on the water column. The small ridge in Faial NW (near Praia do Norte) hosted an impressive and diverse aggregation of *Candidella imbricata* and *Errina atlantica*, with other less abundant species such as *Lophelia pertusa* and *Madrepora oculata*, usually over a bed of dead coral framework. Hidden below the rocky overhangs, large colonies of the black coral *Leiopathes* cf. *expansa* were observed. This area also contained an assemblage of the “bubblegum” coral *Paragorgia johnsoni* in its usual red and white morphotypes. Some of the **small seamounts of this area may fit some of the FAO criteria that defines what constitutes a VME.**
4. Throughout the dives conducted during this cruise, many commercially important fish species were commonly recorded, such as the bluemouth rockfish (*Helicolenus dactylopterus*), orange roughy (*Hoplostethus atlanticus*), silver roughy (*Hoplostethus mediterraneus*), and congers (*Conger conger*), reinforcing the idea of the slopes south of Faial Island as an important deep-sea area.
5. In the **slopes south of Pico island**, we observed several alfonsinos (*Beryx decadactylus*), one of the most valuable fish species in the Azores, with off-vessel prices reaching over 40 € per kilo. Among the vast range of coral species present in the areas, an impressive black coral colony of the genus *Bathypathes* was observed in Baixo de São Mateus. A vast aggregations of the bird’s nest sponge *Pheronema carpenteri* was also discovered in this area.

Table 1. Areas surveyed during each of the three legs of MapGES 2021 cruise, with details on the amount of underwater terrain explored (km) and time (h) of filming accomplished.

Leg	Dates	Areas explored	Dives	km	Bottom time (h)
1	15-23 Jul. 2021	Faial and Pico island slopes	61	31	61
2	10-16 Aug. 2021	Slopes of Corvo	18	8	20
3	25 Aug. - 15 Sept. 2021	Faial, Pico, São Jorge island slopes	68	48	68
Total			147	87	149

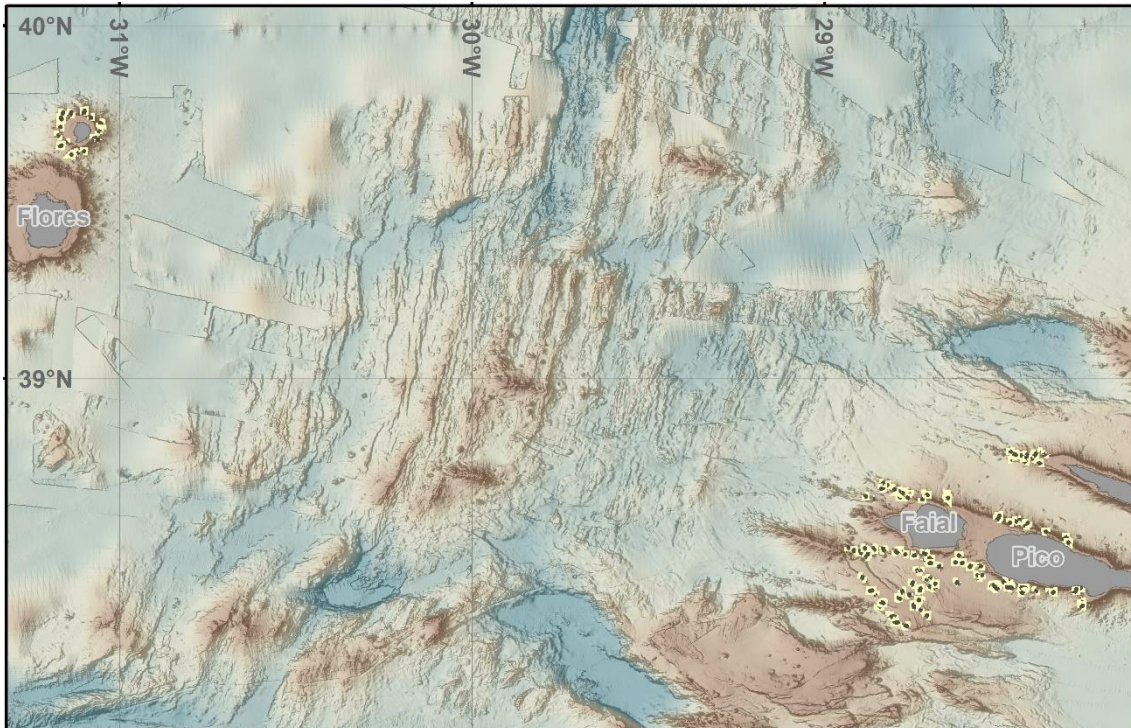


Figure 1. Location of the 147 dives performed with the Azor drift-cam in seamounts and island slopes around the eastern and western group during the 3 legs of the MapGES 2021.



Figure 2. Selection of screenshots taken from the footage recorded during MapGES 2021.

Table 2. Compilation of the stations performed during MapGES 2021 cruise.

St	Location	Date	Time		Start position		End position		Depth (m) start-end	Dist. (m)
			Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)		
1	Faial S	15/07/21	08:49	08:57						
2	Faial S	15/07/21	09:04	09:10						
3	Faial S	15/07/21	09:26	10:08	38.502	-28.771	38.502	-28.774	740-767	310
4	Faial S	15/07/21	11:00	11:32	38.511	-28.785	38.513	-28.787	516-539	300
5	Faial S	15/07/21	12:09	12:53	38.506	-28.792	38.513	-28.802	730-730	1,090
6	Faial, Filhas Condor	15/07/21	13:40	15:05	38.512	-28.832	38.523	-28.835	689-758	1,230
7	Faial, Filhas Condor	15/07/21	15:51	16:58	38.514	-28.859	38.520	-28.863	868-602	800
8	Faial, Filhas Condor	15/07/21	17:52	18:52	38.493	-28.884	38.497	-28.880	940-829	510
9	Faial S	16/07/21	09:36	10:30	38.488	-28.717	38.485	-28.718	651-747	290
10	Faial S	16/07/21								
11	Faial S	16/07/21	11:26	12:04	38.485	-28.705	38.484	-28.712	509-729	580
12	Faial S	16/07/21	14:17	15:30	38.470	-28.674	38.466	-28.676	531-470	500
13	Faial, Canal S	16/07/21	16:30	17:08	38.480	-28.628	38.479	-28.630	418-513	290
14	Faial, Mont'Ana	16/07/21	17:56	19:30	38.472	-28.585	38.467	-28.592	282-339	790
15	Faial S	21/07/21	08:46	09:53	38.489	-28.700	38.488	-28.697	536-624	280
16	Faial S	21/07/21	10:32	11:19	38.491	-28.708	38.492	-28.700	517-569	710
17	Faial S	21/07/21	12:22	13:25	38.477	-28.702	38.476	-28.692	707-712	810
18	Faial S	21/07/21	14:31	15:33	38.499	-28.747	38.500	-28.742	597-534	450
19	Faial S	21/07/21	16:06	16:47	38.503	-28.718	38.506	-28.718	327-223	330
20	Faial S	21/07/21	17:13	17:39	38.502	-28.713	38.502	-28.713	254-253	10
21	Faial S	21/07/21	17:52	18:16	38.503	-28.714	38.502	-28.715	242-251	190
22	Faial S, Bx da Feteira	21/07/21	18:56	19:37	38.467	-28.674	38.466	-28.676	407-488	160
23	Faial, N	23/07/21	09:04	10:10	38.672	-28.655	38.668	-28.651	609-588	530
24	Faial, N	23/07/21	10:49	11:18	38.662	-28.652	38.662	-28.648	573-629	390
25	Faial, N	23/07/21	12:12	12:40	38.674	-28.715	38.674	-28.711	609-574	320
26	Faial, N	23/07/21	13:14	13:48	38.670	-28.712	38.670	-28.707	575-591	460
27	Faial, NW	23/07/21	14:59	15:37	38.666	-28.788	38.662	-28.787	731-804	400
28	Faial, NW	23/07/21	16:16	17:17	38.673	-28.759	38.669	-28.759	575-486	400
29	Faial, NW	23/07/21	17:47	18:46	38.669	-28.760	38.666	-28.761	446-394	260
30	Faial, NW	24/07/21	09:13	09:59	38.661	-28.723	38.657	-28.723	335-153	450
31	Faial, NW	24/07/21	10:34	11:39	38.664	-28.767	38.662	-28.762	442-396	480
32	Faial, NW	24/07/21	12:20	13:37	38.683	-28.792	38.679	-28.788	781-630	590
33	Faial, NW	24/07/21	14:13	15:21	38.677	-28.780	38.674	-28.776	687-598	450
34	Faial, NW	24/07/21	16:20	17:11	38.699	-28.824	38.697	-28.826	921-864	220
35	Faial, NW	24/07/21	18:05	18:37	38.691	-28.801	38.690	-28.803	720-671	190
36	Faial, Canal S	25/07/21	08:43	09:40	38.424	-28.624	38.421	-28.627	787-660	440
37	Pico, SW	25/07/21	10:38	10:57	38.443	-28.568	38.442	-28.569	690-692	180
38	Pico, SW	25/07/21	12:03	13:21	38.417	-28.521	38.413	-28.528	727-754	730
39	Pico, SW	25/07/21	14:18	14:51	38.415	-28.518	38.417	-28.522	668-741	370
40	Pico, SW	25/07/21	15:46	16:24	38.412	-28.475	38.415	-28.483	567-644	800
41	Pico, SW	25/07/21	17:07	18:46	38.407	-28.469	38.410	-28.488	597-617	1,670
42	Pico, SW	26/07/21	09:07	09:55	38.422	-28.491	38.427	-28.496	571-562	690
43	Pico, SW	26/07/21	10:39	11:49	38.404	-28.510	38.413	-28.519	758-642	1,270
44	Pico, SW	26/07/21	13:03	14:35	38.402	-28.429	38.409	-28.431	648-514	800
45	Pico, SW	27/07/21	09:08	10:17	38.408	-28.436	38.408	-28.446	446-482	900
46	Pico, SW	27/07/21	11:04	12:02	38.394	-28.435	38.400	-28.438	882-749	740
47	Pico, SW	27/07/21	13:11	14:15	38.397	-28.402	38.400	-28.399	767-679	500
48	Pico, SW	27/07/21	15:02	15:34	38.396	-28.361	38.396	-28.364	714-681	240
49	Pico, SW	27/07/21	16:15	16:51	38.397	-28.351	38.397	-28.350	753-759	100
50	Pico, SW	27/07/21	18:37	18:52	38.444	-28.553	38.443	-28.556	643-660	260
51	Pico, SW	28/07/21	09:35	10:41	38.392	-28.437	38.396	-28.443	785-782	690
52	Pico, S, Lajes	28/07/21	12:05	12:26	38.394	-28.355	38.394	-28.355	812-813	30
53	Pico, S, Lajes	28/07/21	13:44	15:26	38.350	-28.273	38.354	-28.268	916-630	610
54	Pico, S, Lajes	28/07/21	16:09	17:59	38.356	-28.270	38.357	-28.265	589-427	460
55	Faial, Filhas Condor	29/07/21	09:29	10:37	38.507	-28.877	38.501	-28.878	681-522	650
56	Faial, Filhas Condor	29/07/21	11:21	12:27	38.511	-28.900	38.506	-28.897	628-540	690
57	Faial, Filhas Condor	29/07/21	13:12	14:39	38.515	-28.918	38.510	-28.917	590-443	540
58	Faial, Filhas Condor	29/07/21	15:20	16:12	38.523	-28.933	38.519	-28.933	481-458	390
59	Faial, Filhas Condor	29/07/21	17:00	18:15	38.521	-28.887	38.519	-28.886	901-871	260
60	Faial, NW	30/07/21	09:48	10:25	38.688	-28.799	38.685	-28.803	632-605	380
61	Faial, NW	30/07/21	11:13	11:53	38.707	-28.833	38.703	-28.835	829-778	510
62	Faial, NW	30/07/21	12:38	14:21	38.691	-28.834	38.687	-28.842	934-828	800

St	Location	Date	Time		Start position		End position		Depth (m) start-end	Dist. (m)
			Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)		
63	Faial, NW	30/07/21	15:13	16:16	38.658	-28.858	38.658	-28.863	737-668	420
64	Faial, NW	30/07/21	17:01	18:02	38.666	-28.884	38.666	-28.885	883-852	120
65	Corvo, SW	10/08/21	08:36	08:49	39.681	-31.073	39.682	-31.070	130-156	220
66	Corvo, NW	10/08/21	09:31	10:01	39.702	-31.059	39.700	-31.056	440-471	380
67	Corvo, NW	10/08/21	10:49	11:26	39.708	-31.050	39.704	-31.046	633-740	560
68	Corvo, NW	10/08/21	13:24	13:42	39.725	-31.054	39.721	-31.050	584-700	490
69	Corvo, SE	13/08/21	13:20	14:19	39.680	-31.062	39.677	-31.061	464-671	380
70	Corvo, SE	13/08/21	16:22	16:49					516-593	
71	Corvo, SE	13/08/21	17:34	18:08	39.645	-31.100	39.644	-31.103	461-476	230
72	Corvo, SW	13/08/21	19:01	19:44	39.640	-31.116	39.639	-31.119	534-587	270
73	Corvo, NW	14/08/21	08:52	10:03	39.742	-31.082	39.734	-31.081	620-179	810
74	Corvo, NW	14/08/21	10:48	12:15	39.759	-31.099	39.749	-31.101	677-372	1,080
75	Corvo, NW	14/08/21	13:44	14:57	39.754	-31.136	39.748	-31.139	791-468	790
76	Corvo, NW	14/08/21	15:54	16:40	39.755	-31.160	39.751	-31.161	974-751	470
77	Corvo, SW	15/08/21	09:03	10:04	39.661	-31.164	39.661	-31.170	706-647	530
78	Corvo, SW	15/08/21	11:25	11:39	39.663	-31.146	39.663	-31.147	550-548	50
79	Corvo, SW	15/08/21	12:14	13:12	39.671	-31.152	39.669	-31.150	434-279	310
80	Corvo, SW	15/08/21	13:55	14:55	39.691	-31.172	39.688	-31.175	650-586	420
81	Corvo, SW	15/08/21	16:05	17:00	39.636	-31.137	39.635	-31.132	857-745	390
82	Corvo, SW	15/08/21	17:46	18:13	39.632	-31.137	39.632	-31.134	654-603	230
83	Corvo, NW	16/08/21	09:16	09:55	39.714	-31.168	39.711	-31.168	514-469	320
84	Corvo, NW	16/08/21	10:45	10:46	39.736	-31.165	39.736	-31.165	779-779	
85	Pico S, Lajes	25/08/21	09:53	10:37	38.395	-28.351	38.392	-28.354	828-818	400
86	Pico S, Lajes	25/08/21	11:34	12:40	38.404	-28.286	38.396	-28.289	371-432	910
87	Pico S, Lajes	25/08/21	13:10	14:18	38.400	-28.294	38.398	-28.296	500-555	290
88	Pico S, Lajes	25/08/21	15:06	16:14	38.408	-28.276	38.405	-28.276	48-109	330
89	Pico S, Lajes	25/08/21	17:13	18:11	38.367	-28.272	38.358	-28.274	619-485	1,080
90	Baixo de São Mateus	26/08/21	08:57	09:40	38.455	-28.728	38.452	-28.728	771-820	360
91	Baixo de São Mateus	26/08/21	10:20	10:55	38.458	-28.737	38.454	-28.741	851-828	550
92	Baixo de São Mateus	26/08/21	11:36	12:45	38.457	-28.733	38.452	-28.738	822-765	720
93	Baixo de São Mateus	26/08/21	13:43	15:02	38.423	-28.751	38.415	-28.753	838-779	850
94	Baixo de São Mateus	26/08/21	15:54	17:26	38.406	-28.728	38.394	-28.730	768-717	1,340
95	Baixo de São Mateus	26/08/21	18:06	18:59	38.406	-28.731	38.398	-28.729	799-719	920
96	São Jorge W, Rosais	30/08/21	10:04	11:06	38.784	-28.458	38.787	-28.465	661-605	750
97	São Jorge W, Rosais	30/08/21	12:00	12:42	38.782	-28.440	38.782	-28.449	446-419	750
98	São Jorge W, Rosais	30/08/21	13:16	14:04	38.779	-28.454	38.785	-28.461	690-657	940
99	São Jorge W, Rosais	30/08/21	14:49	15:44	38.775	-28.428	38.785	-28.426	472-365	1,050
100	São Jorge W, Rosais	30/08/21	16:20	17:50	38.762	-28.434	38.770	-28.429	845-444	940
101	São Jorge W, Rosais	30/08/21	18:13	18:35	38.772	-28.414	38.774	-28.412	269-272	300
102	São Jorge W, Rosais	31/08/21	09:40	11:10	38.791	-28.474	38.797	-28.474	878-863	640
103	São Jorge W, Rosais	31/08/21								
104	São Jorge W, Rosais	31/08/21	13:06	14:29	38.771	-28.438	38.778	-28.431	643-415	1,020
105	São Jorge W, Rosais	31/08/21	15:00	16:10	38.781	-28.406	38.788	-28.402	428-363	940
106	São Jorge W, Rosais	31/08/21	16:42	18:25	38.759	-28.395	38.762	-28.389	467-182	630
107	Baixo de São Mateus	03/09/21	09:03	09:43	38.421	-28.686	38.416	-28.685	749-749	560
108	Baixo de São Mateus	03/09/21	10:47	11:45	38.374	-28.733	38.372	-28.733	676-640	210
109	Agulhas 12 Milhas	03/09/21	12:27	13:07	38.372	-28.733	38.369	-28.725	629-620	790
110	Baixo de São Mateus	03/09/21	14:08	14:50	38.413	-28.705	38.407	-28.700	809-738	680
111	Baixo de São Mateus	03/09/21	15:28	16:04	38.408	-28.690	38.404	-28.686	625-630	580
112	Baixo de São Mateus	03/09/21	16:48	17:05	38.431	-28.711	38.427	-28.711	644-639	430
113	Baixo de São Mateus	03/09/21	17:47	18:15	38.438	-28.701	38.433	-28.702	737-690	490
114	Baixo de São Mateus	03/09/21	18:51	19:32	38.423	-28.688	38.419	-28.690	711-672	430
115	Agulhas 12 Milhas	06/09/21	09:19	10:13	38.391	-28.762	38.386	-28.760	741-596	540
116	Agulhas 12 Milhas	06/09/21	10:52	12:19	38.401	-28.782	38.392	-28.778	783-622	980
117	Agulhas 12 Milhas	06/09/21	12:54	14:10	38.384	-28.790	38.375	-28.787	556-546	1,090
118	Agulhas 12 Milhas	06/09/21	14:53	16:33	38.364	-28.747	38.347	-28.747	592-526	1,970
119	Agulhas 12 Milhas	06/09/21	17:31	18:02	38.346	-28.727	38.341	-28.729	643-529	620
120	Agulhas 12 Milhas	06/09/21	18:35	19:12	38.331	-28.710	38.324	-28.713	684-615	760
121	São Jorge W, Rosais	07/09/21	09:52	10:50	38.776	-28.465	38.781	-28.470	937-917	770
122	São Jorge W, Rosais	07/09/21								
123	São Jorge W, Rosais	07/09/21	12:39	13:27	38.784	-28.372	38.784	-28.371	434-488	80
124	São Jorge W, Rosais	07/09/21	13:53	14:33	38.782	-28.380	38.783	-28.380	341-355	120
125	São Jorge W, Rosais	07/09/21	15:16	15:46	38.786	-28.374	38.786	-28.376	501-445	110
126	São Jorge W, Rosais	07/09/21	16:47	17:30	38.794	-28.381	38.790	-28.385	650-598	560

St	Location	Date	Time		Start position		End position		Depth (m) start-end	Dist. (m)
			Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)		
127	Agulhas 12 Milhas	08/09/21	10:03	10:58	38.432	-28.896	38.440	-28.891	814-640	950
128	Agulhas 12 Milhas	08/09/21	12:03	13:20	38.399	-28.872	38.399	-28.864	955-760	740
129	Agulhas 12 Milhas	08/09/21	14:01	14:31	38.387	-28.858	38.385	-28.855	880-863	320
130	Agulhas 12 Milhas	08/09/21	15:18	15:55	38.368	-28.841	38.363	-28.831	654-562	1,020
131	Agulhas 12 Milhas	08/09/21	16:46	17:54	38.361	-28.850	38.351	-28.843	881-865	1,320
132	Agulhas 12 Milhas	09/09/21	10:16	10:58	38.326	-28.811	38.324	-28.813	537-558	270
133	Agulhas 12 Milhas	09/09/21	11:29	12:49	38.329	-28.802	38.327	-28.805	579-645	290
134	Agulhas 12 Milhas	09/09/21	13:35	14:41	38.329	-28.820	38.330	-28.815	625-818	420
135	Agulhas 12 Milhas	09/09/21	15:25	16:46	38.311	-28.802	38.310	-28.788	732-964	1,220
136	Agulhas 12 Milhas	09/09/21								
137	Faial, Canal S	10/09/21	08:18	09:10	38.497	-28.618	38.500	-28.620	353-218	390
138	Faial, Canal S	10/09/21	09:59	10:30	38.478	-28.609	38.476	-28.614	559-530	550
139	Faial, Canal S	10/09/21	11:42	13:07	38.442	-28.561	38.436	-28.567	739-744	830
140	Faial, Canal S	10/09/21	14:00	14:18	38.471	-28.556	38.467	-28.557	316-186	430
141	Faial, Canal S	10/09/21	14:42	15:28	38.473	-28.561	38.466	-28.563	329-273	800
142	Faial, Canal S	10/09/21								
143	Pico NW	14/09/21	08:57	10:30	38.613	-28.505	38.600	-28.512	692-200	1,510
144	Pico NW	14/09/21	11:39	12:11	38.594	-28.424	38.587	-28.425	734-486	800
145	Pico NW	14/09/21	12:22	14:09	38.591	-28.424	38.588	-28.431	622-466	740
146	Pico NW	14/09/21	14:44	15:05	38.595	-28.454	38.594	-28.457	588-320	280
147	Pico NW	14/09/21	15:37	16:30	38.597	-28.455	38.596	-28.461	471-388	550
148	Pico NW	14/09/21	17:04	18:13	38.600	-28.443	38.601	-28.452	708-504	740
149	Pico NW	14/09/21	19:03	19:44	38.592	-28.475	38.591	-28.474	952-415	140
150	Pico NW	15/09/21	09:35	10:54	38.539	-28.310	38.533	-28.306	575-401	710
151	Pico NW	15/09/21	11:26	12:32	38.533	-28.309	38.528	-28.309	339-100	580
152	Pico NW	15/09/21	13:28	14:04	38.550	-28.318	38.552	-28.313	682-782	440
153	Pico NW	15/09/21	14:57	15:33	38.546	-28.327	38.546	-28.322	399-428	400
154	Pico NW	15/09/21	16:16	17:37	38.565	-28.375	38.565	-28.369	389-350	550
155	Pico NW	15/09/21	18:25	19:24	38.583	-28.435	38.583	-28.390	399-330	3,880

Acknowledgments

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Leg 1

Slopes of the islands of Faial and Pico on board of RV Arquipélago

Objective: to conduct a rapid assessment of the deep-sea benthic communities dwelling on the slopes of the islands of Faial and Pico on board of RV Arquipélago. These dives aim to contribute to the overall goal of better understanding the composition, diversity, and spatial distribution of deep-sea benthic communities in the Azores, the distribution of Vulnerable Marine Ecosystems (VMEs) and commercial fish species and assess their environmental status.

Statistics: We performed 61 dives with the Azor drift-cam down to 1000 m depth, covering 31 km of the seafloor and producing 61 hours of video footage.

Vessel: RV Arquipélago

Dates: 15-23 July 2021

Scientific team: Telmo Morato (chief scientist), Luís Rodrigues, Sérgio Gomes, Manuela Ramos, Guilherme Gonçalves, Gerald H. Taranto



Figure 3. Part of the Scientific team on the RV Arquipélago that participated in Leg 1 of the MapGES 2021 cruise.

Highlights:

1. During the first leg of the MapGES 2021 cruise, we were able to perform 61 dives with the Azor drift-cam down to 1000 m depth, covering 31 km of the seafloor, mostly around Faial and Pico Islands.

2. The island slopes around Faial Island were mostly covered by soft sedimented and coral rubble deposits at the base of the slopes explored, with lots of marine snow visible on the water column. With some exceptions, the deepest areas hosted low abundance and diversity of megabenthic fauna, with soft and flat grounds hosting some sea urchins and xenophyophores.
3. The small ridge in Faial NW (near Praia do Norte) hosted an impressive and diverse benthic assemblage with aggregations of *Candidella imbricata* and *Errina atlantica*, as well as other less common species such as *Lophelia pertusa* and *Madrepora oculata*, usually over a bed of dead coral framework. Hidden below rocky overhangs, large colonies of the black coral *Leiopathes expansa* were observed. This area also hosts an assemblage of the “bubblegum” coral *Paragorgia johnsoni* in its usual red and white morphotypes. Some of the small seamounts of this area may fit some of the FAO criteria that defines what constitutes a VME.
4. In the slopes south of Pico island, we observed several alfonsinos (*Beryx decadactylus*). This is one of the most valuable fish species in the Azores with off-vessel prices reaching over 40€ per kilo. The deepest and sedimentary bottoms were characterized by xenophyophores and aggregations of the bird’s nest *Pheronema carpenteri* in patches covered by dead coral framework.
5. Filhas do Condor, near the south slopes of Faial Island, hosted diverse benthic communities clearly stratified by depth. The deepest faunal assemblage was characterized by frequent patches of the primnoid *Candidella imbricata*, the stony corals *Madrepora oculata* and *Leptopsammia formosa*, the bamboo coral *Acanella arbuscula* and its octocoral lookalike *Chrysogorgia* sp. Shallower sections of the seamount chain were dominated by several species of demosponges and occasional patches of the bird’s nest *Pheronema carpenteri*.

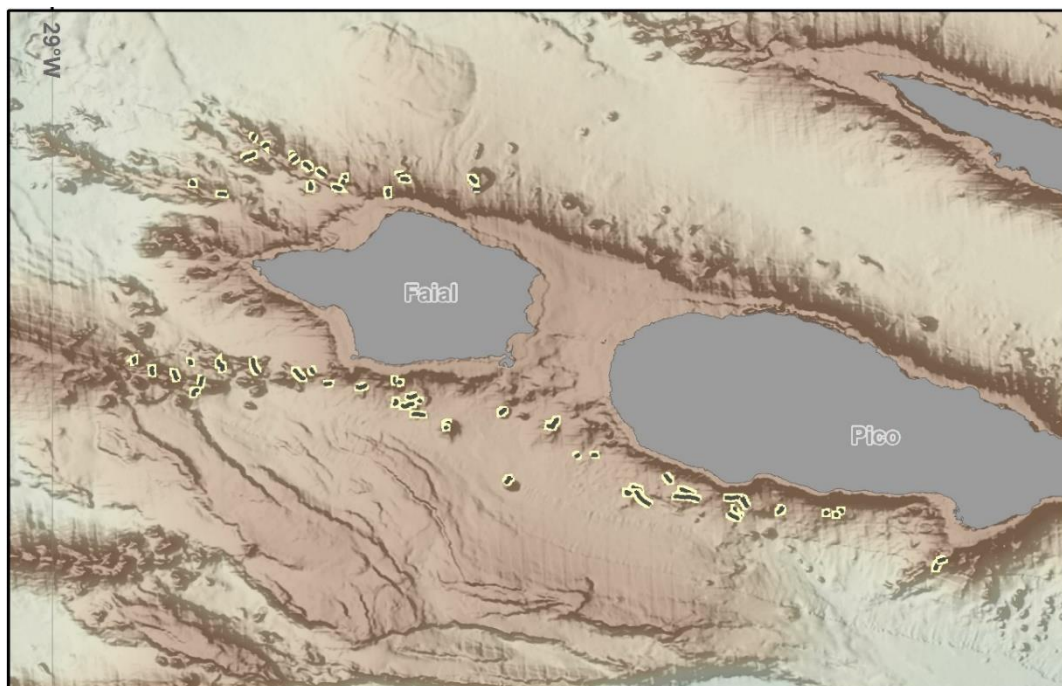


Figure 4. Location of the 61 video transects (black lines) carried out with the Azor drift-cam during Leg 1 of MapGES 2021.

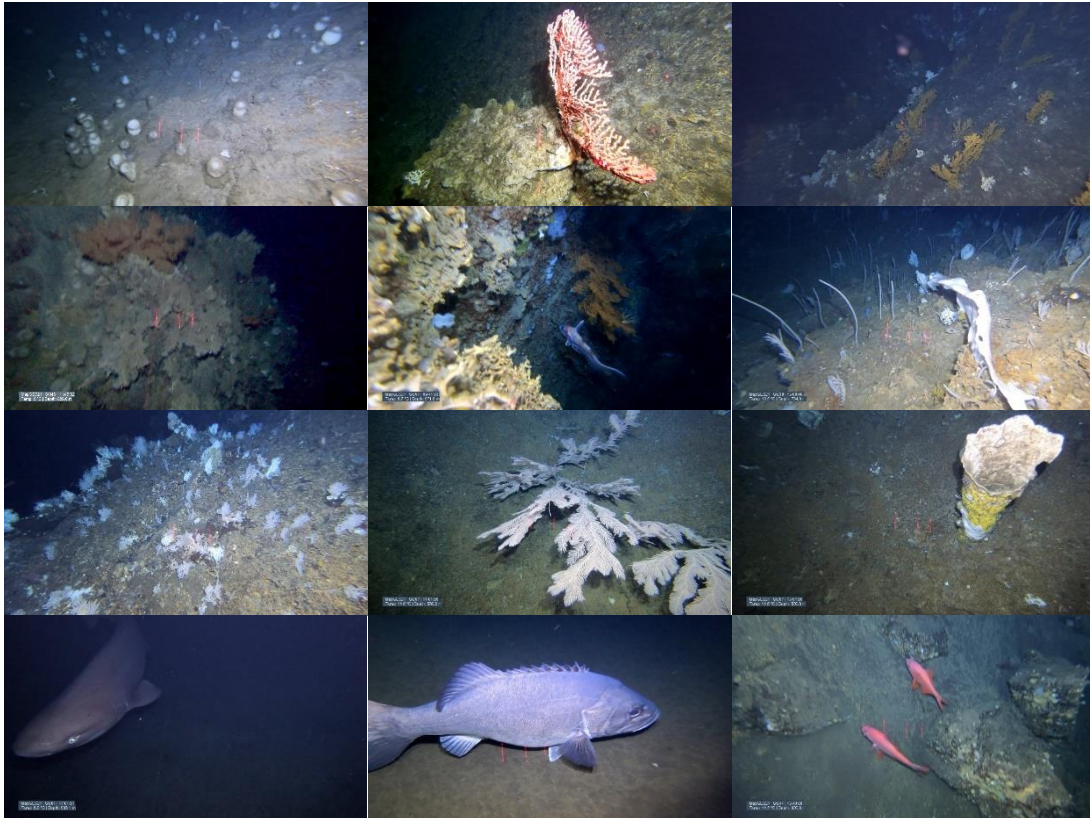


Figure 5. Screenshots taken from the footage recorded during Leg 1 of MapGES 2021 cruise. (a) aggregation of the bird's nest *Pheronema carpenteri* colonizing soft grounds. (b) Colony of the red morphotype of the "bubblegum" coral *Paragorgia cf. johnsoni* (c) Shallow coral garden dominated by *Acanthogorgia* spp. (d,e) Black coral colonies of the species *Leiopathes cf. expansa* growing on tall and deep outcrops. (f) Extensive gardens of *Narella bellissima* and *Narella versluysi* and the lamellate sponge cf. *Poecillastra compressa*. (g) Vast community of the primnoid *Candidella imbricata* and the hydrocoral *Errina atlantica*. (h) Large colonies of the primnoid coral *Callogorgia verticillata*. (i) The massive sponge *Characella pachastrelloides*. (j) Sixgill shark *Hexanchus griseus*. (k) Wreckfish *Polyprion americanus*. (l) Alfonsinos (*Beryx decadactylus*), one of the most valuable fish species in the Azores.

Cruise Diary of Leg 1

15 July 2021

The first day of Leg 1 of MapGES 2021 cruise aimed to test and practice the operation of the Azor drift-cam before moving to more distant areas. Since the crew of RV Arquipélago was on strike for night shifts, we could only operate the vessel between 07:00 to 22:00, always departing from Horta harbor. We left Horta at around 07:30 towards southern Faial, where we performed 6 successful dives (St. 002-008) out of 8 tries, with the first two dives aborted due to issues with the live-view feed. Dives were conducted between 500 and 1015 m depth. The deepest areas explored were characterized by soft grounds, mostly colonized by xenophyophores and a few glass sponges of the species *Hyalonema (Cyliconema) thomsonis*. Motile fauna observed at these depths included sea urchins (*Cidaris cidaris*), shrimps (*Aristaeopsis edwardsianna*) and several small fishes from the family Macrouridae. As slope increased, basalt outcrops began to appear, colonized by sessile fauna, occasionally hosting solitary colonies of *Hemicorallium niobe* and *Errina atlantica*. We also drifted over an extensive community of the gorgonian *Candidella imbricata* near these sections. At around 750 m, the slope became densely colonized by the

primnoids *Narella versluysi* and *Narella bellissima*. The substrate was characterized by a fine layer of soft sediments that covered flat rock bottoms, also hosting the glass sponges *Farrea occa*, *Pheronema carpenteri* and other, more sporadic corals, such as *Acanthogorgia* sp. and *Leptopsammia formosa*. The shallowest areas surveyed were relatively poor in terms of megabenthic fauna, only briefly characterized by large sponges of the species *Characella pachastrelloides* and small soft corals. A few bluemouth rockfish specimens (*Helicolenus dactylopterus*) were also observed. We started transiting back to Horta at 19:00 and arrived in port at 21:00.

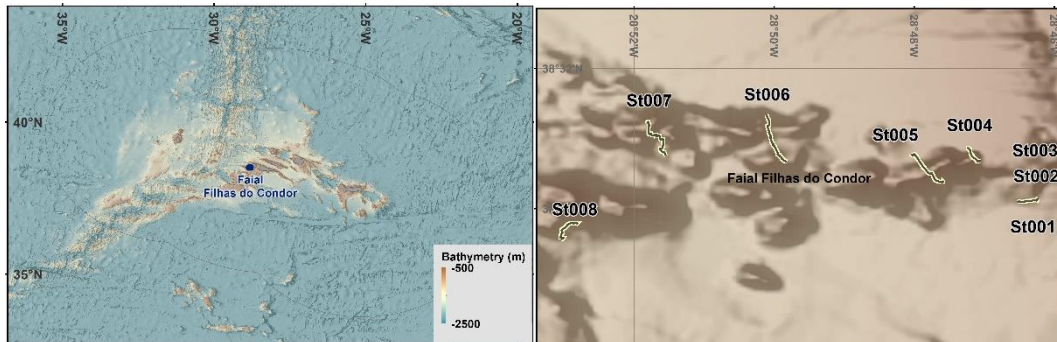


Figure 6. Map showing the dives conducted on day 1 of Leg 1 of MapGES 2021 cruise in the southern slopes of Faial Island.

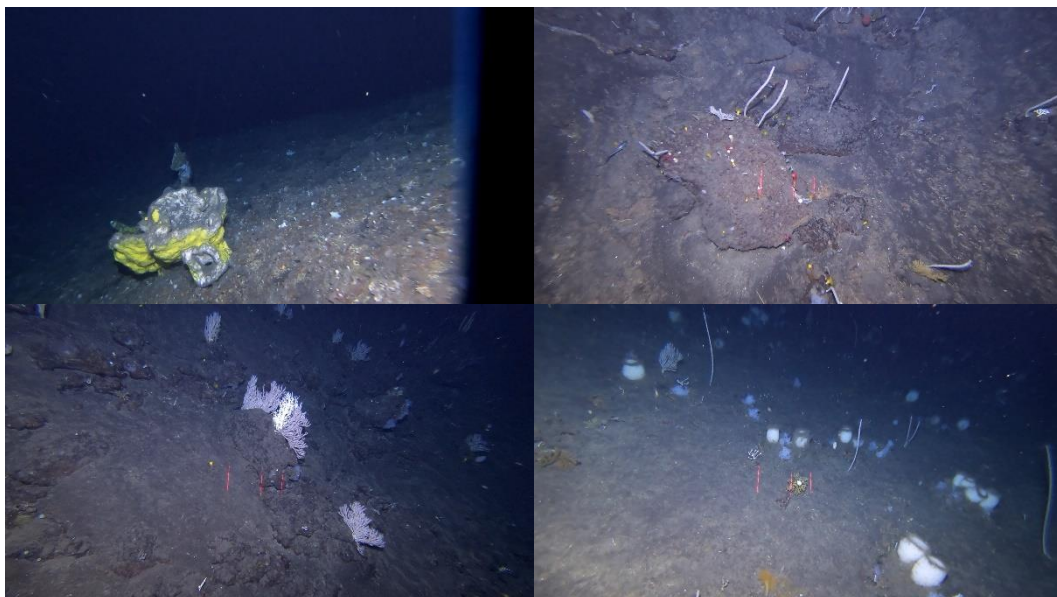


Figure 7. Screenshots taken from the video footage recorded during day 1 of Leg 1 of MapGES 2021 cruise in the southern slopes of Faial Island.

16 July 2021

We left Horta harbor at around 07:30 towards the southern slopes of Faial Island. Even though the second dive (St. 010) was aborted due to technical problems, we were able to conduct 5 successful dives (St. 009-014) between 380 and 750 m depth. Most dives were conducted on heavily sedimented areas, with lots of marine snow visible on the water column. The deepest areas were quite poor in terms of megabenthic fauna, with soft and flat grounds dominating the substrate on which only a few sea urchins and xenophyophores. Coral rubble deposits were found at the base of the slopes explored and steep basalt overhangs observed around 600 m

depth. This change in substrate offered solid ground for small sessile fauna. Only a few large demosponges of the species *Characella pachastrelloides* and *Petrosia crassa* and a couple of solitary colonies of the hydrocoral *Errina dabneyi* could be observed. We began seeing steep basalt overhangs, where the Azor drift-cam was caught for a brief moment. In terms of motile fauna, we observed a sixgill shark (*Hexanchus griseus*), a small ray (possibly *Dipturus intermedius*), several bluemouth rockfish (*Helicolenus dactylopterus*) and a big shoal of boarfish (*Capros aper*). We finished the last dive at around 19:30 and started transiting back to Horta harbor.

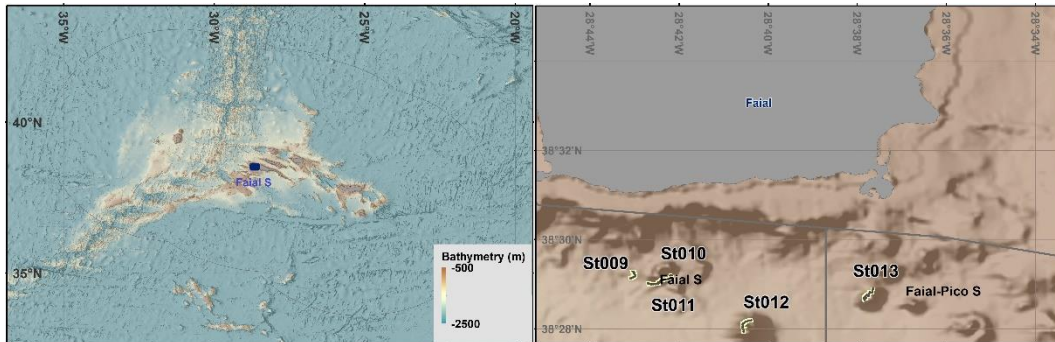


Figure 8. Map showing the dives performed during day 2 of Leg 1 of the MapGES 2021 cruise in the southern slopes of Faial Island.

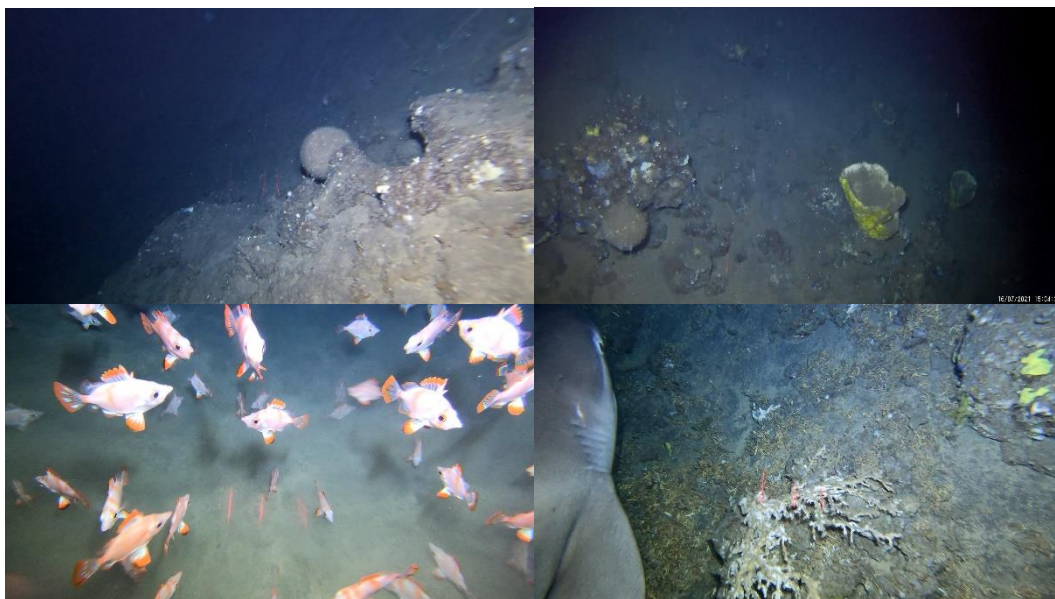


Figure 9. Screenshots taken from the video footage recorded during day 2 of Leg 1 of MapGES 2021 cruise in the southern slopes of Faial Island.

17-18 July 2021

The crew of RV Arquipélago is still on strike for night shifts which limits the distance of possible operations to 20 nm from Horta harbour. This also limits the number of stations that can be conducted, and therefore, we decided not to work during the weekend.

19-20 July 2021

The surveys with the Azor drift-cam on board the RV Arquipélago were cancelled because of the bad weather conditions.

21 July 2021

We left Horta harbor at around 07:30 to continue the deep-sea explorations in the slopes of the southern flank of Faial island. We conducted a total of 8 short dives (St. 015-022) during the whole day, across a depth range of 220 to 790 m. As previous days, the seafloor was dominated by deposits of soft sediments, possibly from terrestrial origin. The flatter and deepest areas were usually less diverse, where the dominating soft grounds were only home to xenophyophores, sea urchins and small shrimps. A large ray (*Dipturus intermedius*) was also observed. As we explored shallower sections, rocky basalts began to host more fauna than the surrounding substrate, where a sponge-dominated community began to surge (700 m depth). Large sponges of the genus *Petrosia* and *Geodia* and the species *Characella pachastrelloides* were observed colonizing the rocky outcrops. A very large wreckfish (*Polyprion americanus*) was also recorded, as well as bluemouth rockfish (*Helicolenus dactylopterus*). Near these depths, we also drifted over a small, relatively flat mound of unconsolidated terrain, hosting a large aggregation of the bird's nest *Pheronema carpenteri*. This community started to become richer in species as depth decreased, including sponges from the genus *Leiodermatium* sp. and other species such as *Macandrewia azorica* and *Neophrissospongia nolitangere*. It was also noteworthy the accumulation of a dead algae (possibly the invasive species *Rugulopteryx okamurae*) usually behind rocky overhangs, as well as drifting across large sedimentary and flat areas. The highlight of the day, however, came in dive 6, where we explored the shallowest areas of the slope. Here, the substrate was dominated by a large and dense aggregation of the gorgonian *Acanthogorgia* sp. together with a white lamellate sponge and many smaller sponges such (e.g. *Haliclona implexa*, *Petrosia* sp.). Several sea cucumbers were observed within this community too. At around 19:40, we started transiting back to harbor.

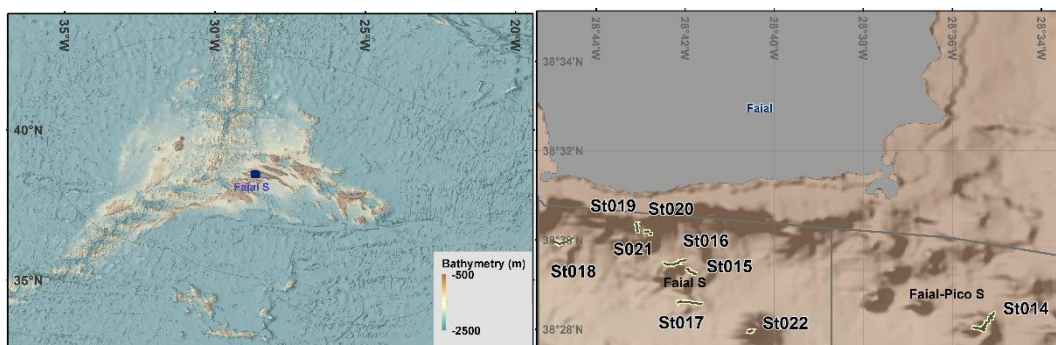


Figure 10. Map showing the location of the dives performed during the day 3 of MapGES 2021 cruise on the southern slopes of Faial Island.



Figure 11. Screenshots taken from the video footage recorded during day 3 of Leg 1 of MapGES 2021 cruise on the southern slopes of Faial island.

22 July 2021

We stayed in the harbour because members of the RV Arquipélago crew were scheduled to take the Covid-19 vaccine.

23 July 2021

We started surbeying in the north and northwest part of Faial at around 09:00, conducting 7 successful dives (St. 023-029) at depths from 400 to 900 m. An issue with the formatting of the datalogger resulted in no depth or temperature data recorded. The benthic assemblages were quite poor, with most substrates relatively bare. As in previous days, the deepest sections covered hosted very little fauna, where only a few tube-dwelling anemones, sea urchins and small glass sponges were seen in the soft grounds. A small deep-sea shark was also recorded. When the rocky outcrops appeared, small white plexaurid corals could be observed, as well as occasional solitary scleractinians of the species *Leptopsammia formosa*. Between 800 m and 600 m, we drifted over steeper and more rugged terrain, with occasional outcrops mostly colonized by small and encrusting sponges and more sporadically by large *Geodia* sp. and small colonies of *Acanthogorgia* sp. Some bluemouth rockfish (*Helicolenus dactyloterus*) and alfonsinos (*Beryx decadatylys*) were seen on these sections, while Macrourids on softer and flatter grounds. Occasionally, solitary corals *Flabellum* sp. were spotted lying on sandy bottoms. At around 500 m, the whip coral *Viminella flagellum* began to dominate the outcrops covered by fine layers of sediment, although in relatively low densities. We got to see a small shoal of cf. *Epigonus* sp. We started transiting back to Horta at around 18:50.

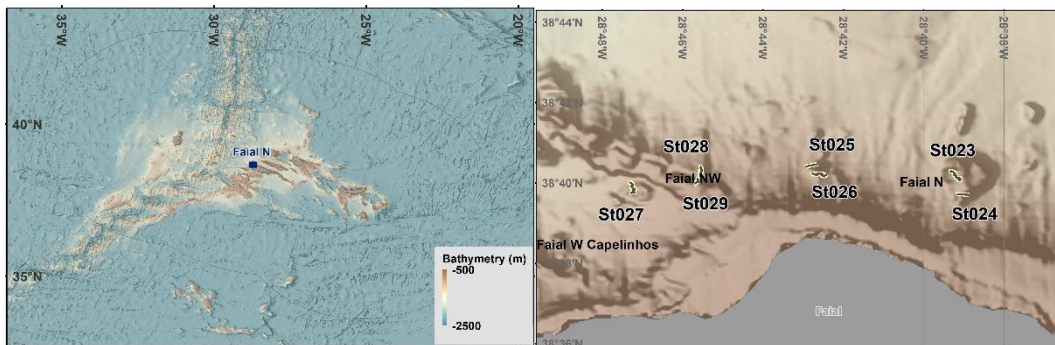


Figure 12. Location of the dives conducted during day 4 of the Leg 1 of MapGES 2021 cruise at the northern slopes of Faial island.

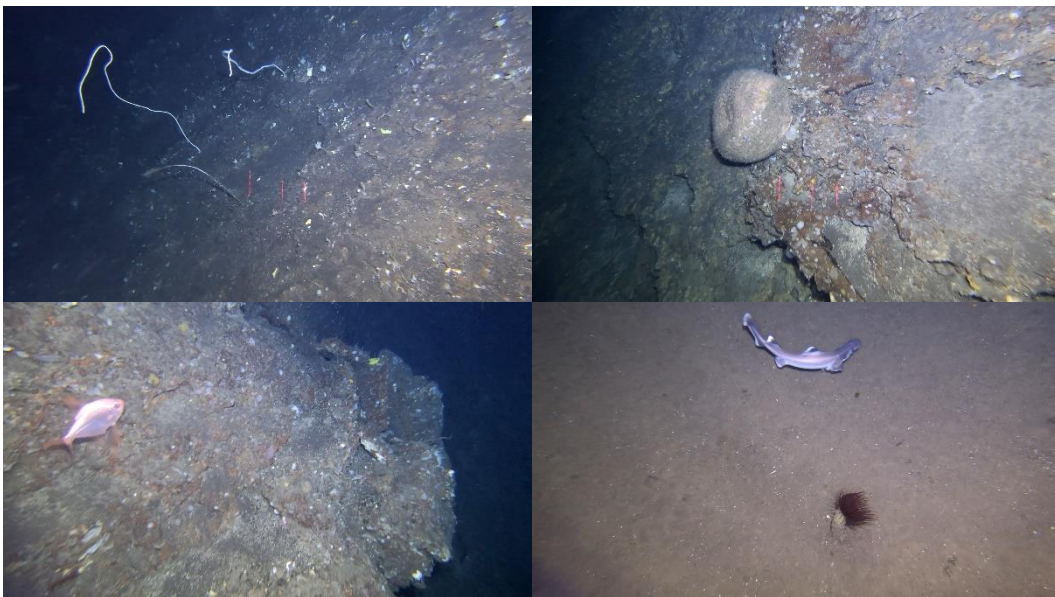


Figure 13. Screenshots taken from the video footage recorded day 4 of MapGES 2021 survey on the northern slopes of Faial Island.

24 July 2021

We left Horta harbor at around 07:30 to continue exploring areas northwest of Faial island. We conducted 6 dives (St. 030-035) between 09:00 and 18:40 across a large depth range, from 184 to 1024 m depth, where impressive and diverse benthic assemblages were observed. There were no technical issues to be reported on this day. The deepest sectors (and further away from Faial Island) contained impressive aggregations of *Candidella imbricata* and *Errina atlantica*, as well as other more sporadic species such as the scleractinians *Lophelia pertusa* and *Madrepora oculata*, usually on a bed of dead coral framework. Hidden below rocky overhangs, large colonies of the black coral *Leiopathes expansa* were also briefly recorded at around 950 m depth. At 850 m, when the slope started to increase, the benthic community changed to one dominated by the primnoids *Narella versluysi* and *Narella bellissima* forming large aggregations. In this community, many colonies of a small plexaurid coral and some glass sponges such as *Regadrella phoenix* and *Asconema* sp. were observed. The decapod *Bathynectes maravigna* and bluemouth rockfishes were also registered within these depths. An impressive assemblage of the “bubblegum” coral *Paragorgia johnsoni* in its usual red and white morphotypes was recorded at around

650 m along with many small soft corals (cf. *Pseudoanthomastus* sp.). From around 500 m depth and upwards, soft sediments became much more common, harboring little fauna until the 300 m depth mark. In these depths, we recorded another benthic community with large and abundant colonies of *Acanthogorgia* sp. growing on basaltic outcrops finely covered with fine sediments, accompanied by several small sponge species, such as *Haliclona implexa*, *Petrosia* sp., *Neophrissospongia nollitangere*, cf. *Poecillastra compressa*, among others. Some offshore rockfishes *Pontinus kuhlii* and several blackspot seabreams *Pagellus bogaraveo* were recorded in these shallower areas. We ended the last dive at around 18:40 and started transiting back to Horta.

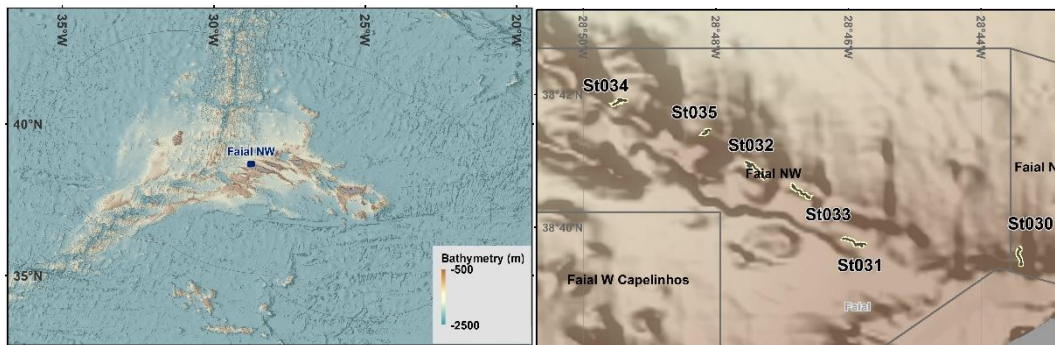


Figure 14. Location of the dives conducted during day 5 of the Leg 1 of MapGES 2021 cruise at the northwestern slopes of Faial Island.



Figure 15. Screenshots taken from the video footage recorded on day 5 of MapGES 2021 survey on the northwestern slopes of Faial Island.

25 July 2021

We received the filmmaker Gonçalo Tocha who was collecting footage of sea activities conducted by locals from the islands of Faial, Pico and São Jorge. We explored the southwestern slopes of Pico Island, where we conducted six successful dives (St. 036-041) at depths between 570 and 845 m. Despite the generally low biodiversity associated with the flatter and softer grounds, some echinoderms, eel-like fishes and a large six-gill shark *Hexanchus griseus* were recorded. At around 770 m depth, we drifted over a vast and diverse coral garden of several different species, dominated by the primnoids *Narella versluysi* and *Narella bellissima*. Other species included the bubble-gum coral *Paragorgia johnsoni*, *Acanthogorgia* sp., and *Hemicorallium niobe*. Many sponges also composed this community, including the hexactinellids cf. *Poecillastra compressa*, *Pheronema carpenteri*, *Asconema fristedti*, and *Regadrella phoenix*. *Mora moro* was among the motile fauna observed. The shallowest sections contained a less diverse benthic community, where lava ballons were colonized by sponges such as *Petrosia* sp., *Geodia* sp., *Neophrissospongia nolitangere*, *Macandrewia azorica* or other smaller species. We also recorded the black crinoid *Cyathidium foresti* attached to the underside of this interesting type of substrate. Bluemouth rockfishes (*Helicolenus dactylopterus*) were also observed. Tall vertical walls were common at around 600 m depth, which made the system to get briefly scrapped, with no major damage to be reported. After the last dive, we started transiting back to Horta at 18:50.

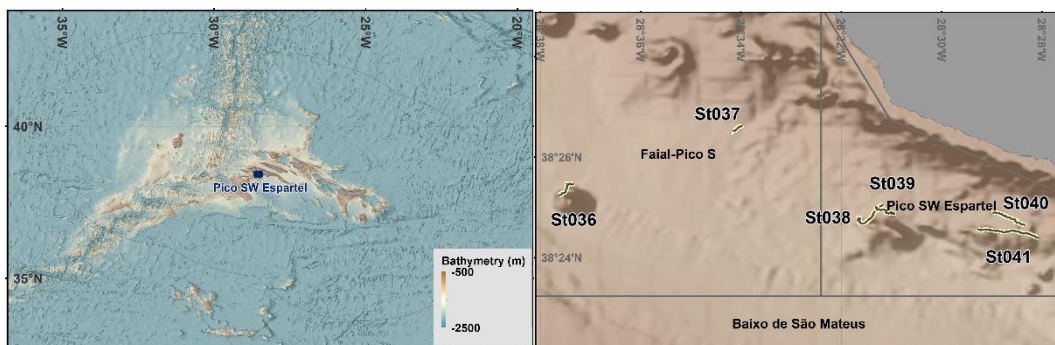


Figure 16. Location of the dives conducted during day 6 of the Leg 1 of MapGES 2021 cruise at the southwestern slopes of Pico Island.



Figure 17. Screenshots taken from the video footage recorded day 6 of MapGES 2021 survey on the southwestern slopes of Pico Island.

26 July 2021

We continued our work on the southwestern slopes of Pico island. Only 3 dives were conducted (St. 042-044) between 550 and 930 m depth. A problem with the hydraulic winch forced the day to end earlier. The first and last dives covered very similar depths, substrates and benthic communities. On both, we first landed on flat and sedimentary areas, but promptly started drifting over basaltic outcrops and pillow lavas. We mostly recorded a sponge dominated assemblages, where *Macandrewia azorica*, *Neophrissospongia nolitangere*, *Characella pachastrelloides*, *Geodia* sp., were observed, besides the many smaller species. We occasionally observed colonies of *Pleurocorallium johnsoni* and *Acanthogorgia* spp., and shoals of cf. *Epigonus* sp., *Beryx decadatyclus* and the occasional bluemouth rockfish *Helicolenus dactylopterus*. The areas surrounding these outcrops were usually characterized by soft substrates colonized by hydrocorals possibly of the species *Lytocarpia myriophyllum*. The second dive of the day was the deepest, starting at 930 m depth on a flat sedimentary area only inhabited by some sea urchins *Cidaris cidaris*. There were patches of dead coral framework partially colonized by the hydrocorals *Errina atlantica* and *Pliobothrus symmetricus*, as well as occasional colonies of the stony coral *Lophelia pertusa*. Some fishes (*Hoplostethus mediterraneus*) were quite common, alongside a chimaera *Hydrolagus pallidus*. As soon as we began moving upslope, at around 800 m depth, the benthic community shifted to the primnoid corals *Narella bellissima* and *Narella versluysi* in large densities. Several sponge species were also observed such as *Regadrella phoenix*, *Asconema fristedti* and *Farrea occa* and occasional soft corals possibly belonging from the genus *Gersemia*. Also noteworthy were the dense patches of the sea urchin *Cidaris cidaris*. Because of a hydraulic winch failure, we had to start transiting back to Horta at 14:35.

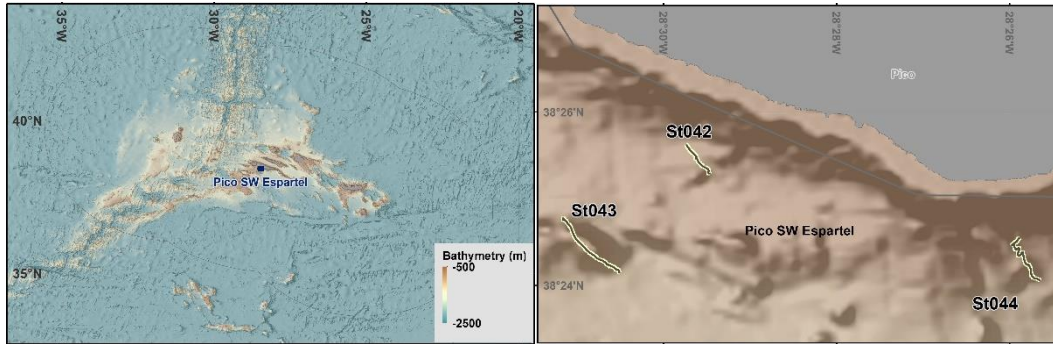


Figure 18. Location of the dives conducted during day 7 of the Leg 1 of MapGES 2021 cruise at the southwestern slopes of Pico Island.

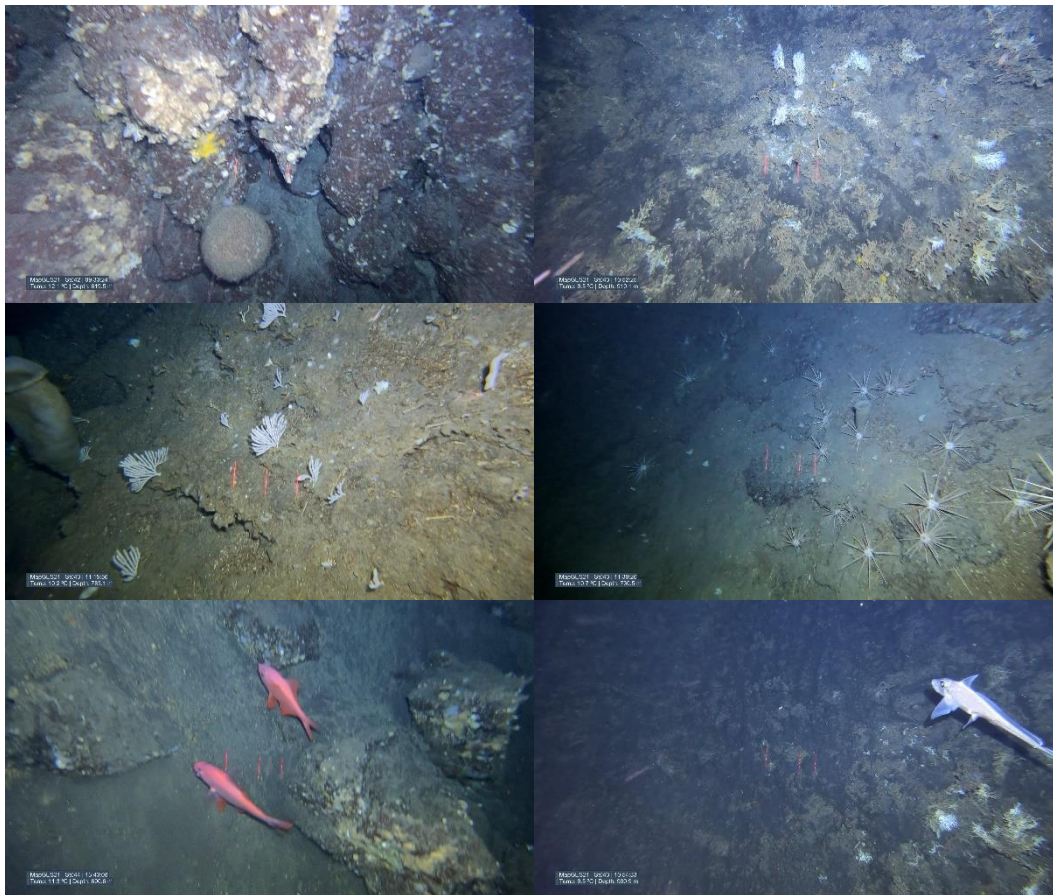


Figure 19. Screenshots taken from the video footage recorded day 7 of MapGES 2021 survey on the southwestern slopes of Pico Island.

27 July 2021

We left Horta harbor at around 07:30 towards the southwestern slopes of Pico island, where we conducted six dives (St. 045-050) between 470 and 980 m depth. The last dive was aborted due to the presence of fishing lines and strong winds which rendered the navigation quite challenging. The deepest dive performed uncovered large rocky outcrops which frequently harbored the stony coral *Leptopsammia formosa*, several glass sponges (*Farrea occa* and *Aphrocallistes beatrix*) and some colonies of the black coral *Leiopathes cf. expansa*, which we just barely saw in the steepest sectors. Large deposits of coral rubble and dead coral framework were present around these outcrops, usually used by other species as attaching substrate, such as the hydrocoral *Errina atlantica* and the glass sponge

Regadrella phoenix. A large black coral colony of the genus *Bathypathes* sp. was also noteworthy at these depths. The sedimentary areas observed at around 900 m depth contained very little benthic fauna apart from sparse corals likely belonging to the family Plexauridae and hydrocorals *Pliobothrus symmetricus*. Occasionally, tall vertical walls appeared, which were poorly colonized by fauna (e.g. *Farrea occa* and small encrusting sponge species). At around 760 m depth, we drifted over occasional patches of the bird's nest *Pheronema carpenteri* on soft grounds. Large pillow lavas were also observed at around these depths, with little associated fauna, including a solitary *Beryx decadatylus*. At around 500 m depth, the same type of substrate began to harbour a more diversity, with occasional patches of the whip-coral *Viminella flagellum* and several small sponges. The soft grounds were mostly characterized by the presence of the hydroids. We started transiting back to Horta at 19:00.

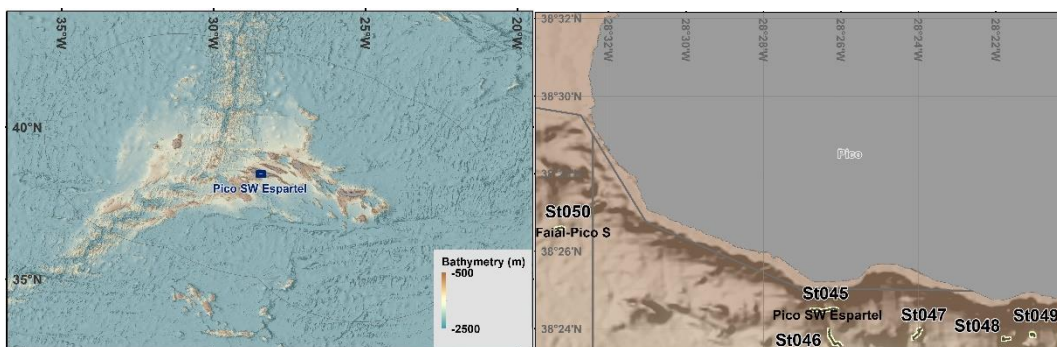


Figure 20. Location of the dives conducted during day 8 of the Leg 1 of MapGES 2021 cruise at the southwestern slopes of Pico Island.

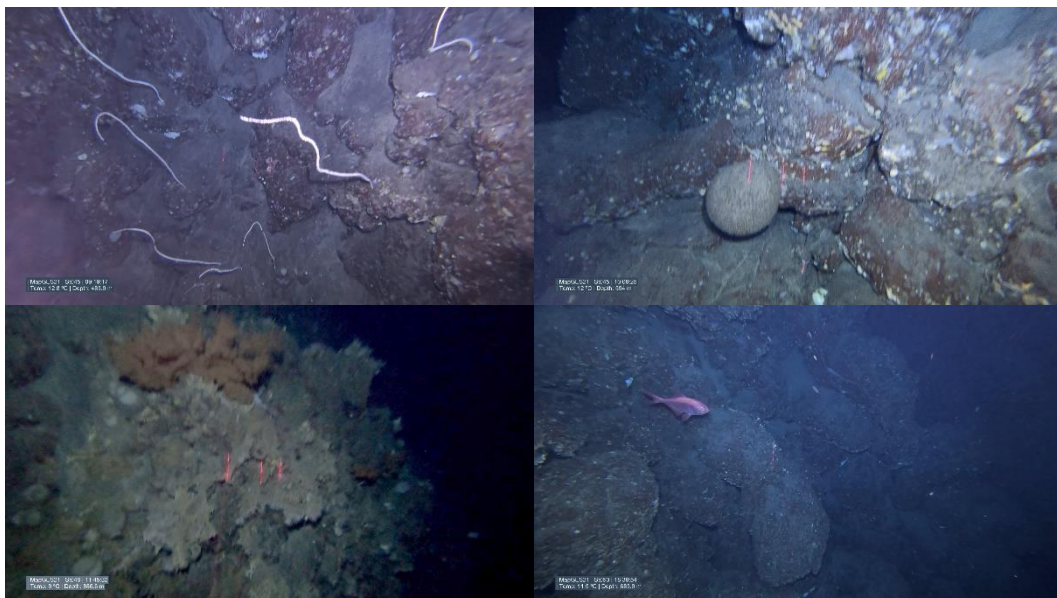


Figure 21. Screenshots taken from the video footage recorded day 8 of MapGES 2021 survey on the southwestern slopes of Pico Island.

28 July 2021

Nuno Pote and Catarina Fazenda joined us for the day to take some video footage of the operations with a drone and to take some photos for our portfolio. We explored the southern slopes of Pico island close to Lajes do Pico, the area furthest away to be explored during the current strike conditions of the vessel's crew. We were only

able to conduct 4 dives (St. 051-054) during the day since the transit time lasts for about three hours each way. Unfortunately, the drift was not ideal, producing non-linear transects or being too slow. We started the day with the deepest dives, between 850 and 1000 m depth, where we recorded interesting benthic fauna across different types of substrates. The deepest and more sedimentary areas were characterized by xenophyophores, tube-dwelling anemones and fields of *Hyalonema* (*Cyliconema*) *thomsonis* and aggregations of *Pheronema carpenteri*. Patches of dead coral framework began appearing at around the 950 m depth, with increasing relevance up until 850 m, forming impressively dense structures, usually used by other benthic organisms as attaching surfaces. Across this depth gradient, we encountered a variety of benthic species such as the stony corals *Lophelia pertusa* and *Leptopsammia formosa*, and the glass sponges *Farrea occa* and *Regadrella phoenix*. Hidden behind crevices along tall vertical walls was the black coral *Leiopathes cf. expansa*. Other more sporadic coral species were the hydrocoral *Errina atlantica* and the bamboo coral *Acanella arbuscula*. We also observed a large weight attached to a longline. At 850 m depth, small colonies of *Acanthogorgia* spp., and higher abundances of glass sponges and soft corals began to appear, as well as sea urchin aggregations (*Cidaris cidaris*). In terms of motile fauna, several silver roughy *Hoplostethus mediterraneus* and a rare sighting of sailfin roughshark *Oxynotus paradoxus* were recorded. The two last dives of the day were the shallowest, below 650 m depth, characterized by low diversities and abundances than the deepest sectors. Apart from smaller sponges, we also observed some larger organisms scattered around the seafloor, most of which belonged to the species *Petrosia crassa*, *Macandrewia azorica*, *Geodia* sp. and very large *Characella pachastrelloides*. Rare colonies of *Errina dabneyi* and the black coral *Elatopathes abietina* were also sighted, as well as the common bluemouth rockfish *Helicolenus dactylopterus*. Several lost fishing lines were registered in the shallowest depths explored. We ended the last dive at around 18:00 and started transiting back to Horta.

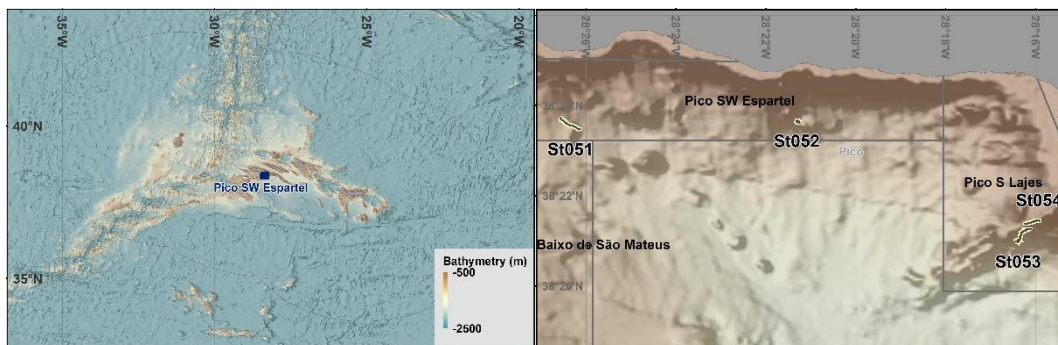


Figure 22. Location of the dives conducted during day 9 of the Leg 1 of MapGES 2021 cruise at the southern slopes of Pico Island.

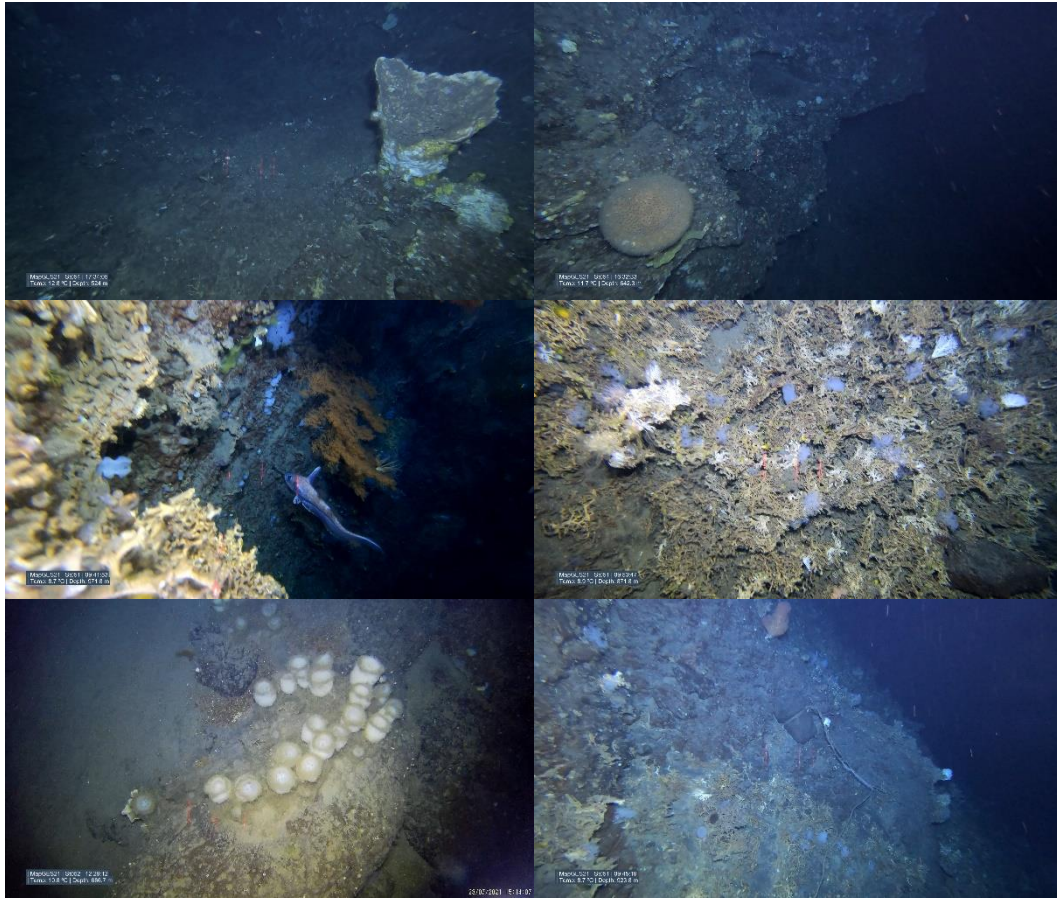


Figure 23. Screenshots taken from the video footage recorded day 9 of MapGES 2021 survey on the southern slopes of Pico Island.

29 July 2021

Today we explored the seamount chain named by Filipe Porteiro as the Filhas do Condor (daughters of the Condor Seamount) on the south slopes of Faial island. We conducted 5 dives (St. 055-059) from about 470 to 1040 m depth. We essentially observed two distinct benthic communities separated. The deepest assemblage thrive on soft grounds and occasional pillow lavas whenever the slope increased. This community was mostly characterized by frequent patches of the primnoid coral *Candidella imbricata*, also composed by other species of scleractinans such as *Madrepora oculata* and *Leptopsammia formosa*, the bamboo coral *Acanella arbuscula* and its gorgonian lookalike *Chrysogorgia* sp. Sporadic colonies of *Hemicorallium niobe* were also seen, as well as the glass sponge *Farrea occa* and other hexactinellids. We also drifted next to a small deep-sea shark, likely from the genus *Deania* and a spiny scorpionfish *Trachyscorpia cristulata*. As we began exploring shallower sections of the seamount chain, a sponge-dominated faunal assemblage was recorded, where several species of demosponges were observed, including *Petrosia crassa*, *Macandrewia azorica*, *Stylocordylla pellita*, cf. *Stryphnus* sp., large specimens of *Characella pachastrelloides* and also occasional patches of the bird's nest sponge *Pheronema carpenteri*. Some sectors of the surveyed slopes at the same depths also hosted tall colonies of the primnoid *Callogorgia verticillata*. Some bluemouth rockfish *Helicolenus dactylopterus* were observed. We started transiting back to Horta at 18:15.

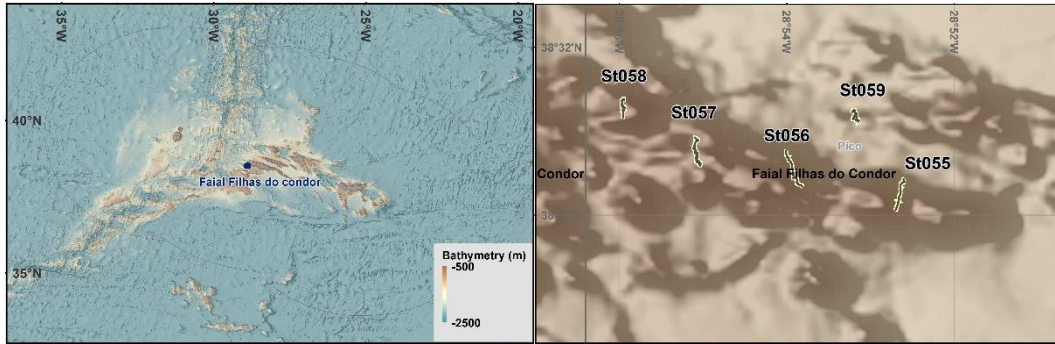


Figure 24. Location of the dives conducted during day 10 of the Leg 1 of MapGES 2021 cruise at the Filhas do Condor, south slopes of Faial Island.

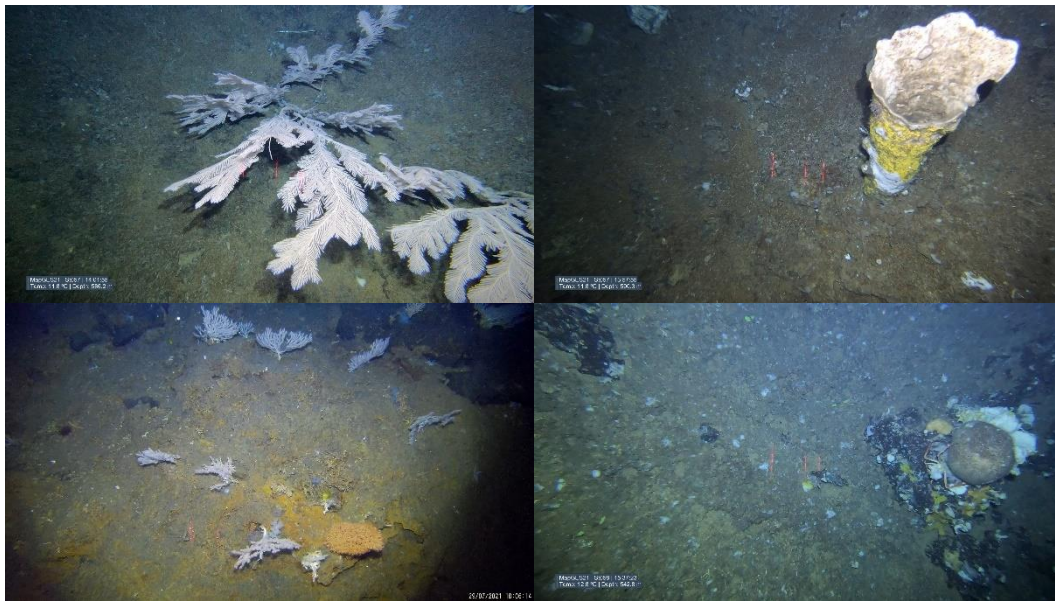


Figure 25. Screenshots taken from the video footage recorded day 10 of MapGES 2021 survey on the Filhas do Condor, south slopes of Faial Island.

30 July 2021

During the last day of Leg 1 we finalized the exploration of the northwestern slopes of Faial island, where we conducted 5 dives (St. 060-064) across a narrower depth gradient than previous days (650-1010 m). The deepest areas were characterized by an interesting and diverse benthic community, alternately dominated by two coral species: *Candidella imbricata* and *Errina atlantica*. Other corals were also observed colonizing these areas, such as the bamboo coral *Acanella arbuscula*, the scleractinians *Madrepora oculata*, *Lophelia pertusa*, *Leptopsammia formosa*, the gorgonian *Chrysogorgia* sp. and occasional colonies of the black corals *Leiopathes expansa* and *Bathypathes* sp. Most of this species were found growing on the occasional small outcrops or boulders surrounded by flat sedimentary areas, which generally hosted little fauna. A large sixgill shark *Hexanchus griseus* and mora fish *Mora moro* were observed, as well as small aggregations of the sea urchin *Cidaris cidaris*. The shallowest dive was performed on a slope characterized by soft sediments, where occasional colonies of the primnoids *Narella bellissima* and *Narella versluyisi* were found attached to the available basalts. Several bluemouth rockfish *Helicolenus dactylopterus* were also sighted. The last dive finished at about 18:00 and we started transiting back to Horta to prepare demobilization.

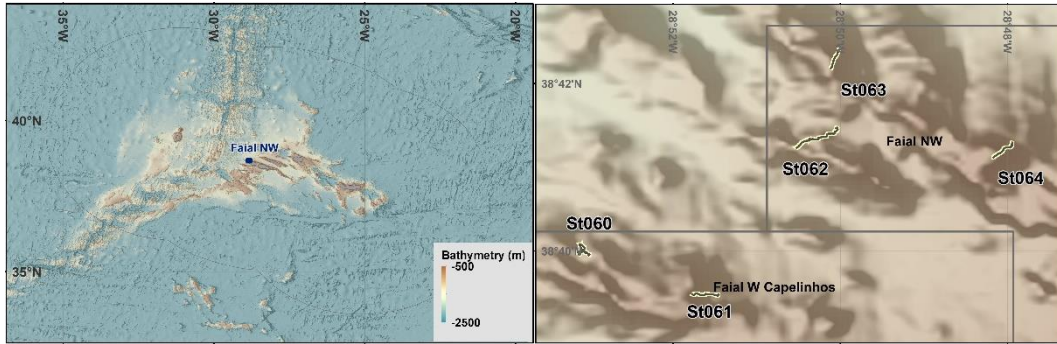


Figure 26. Location of the dives conducted during day 11 of the Leg 1 of MapGES 2021 cruise at the northwestern slopes of Faial Island.

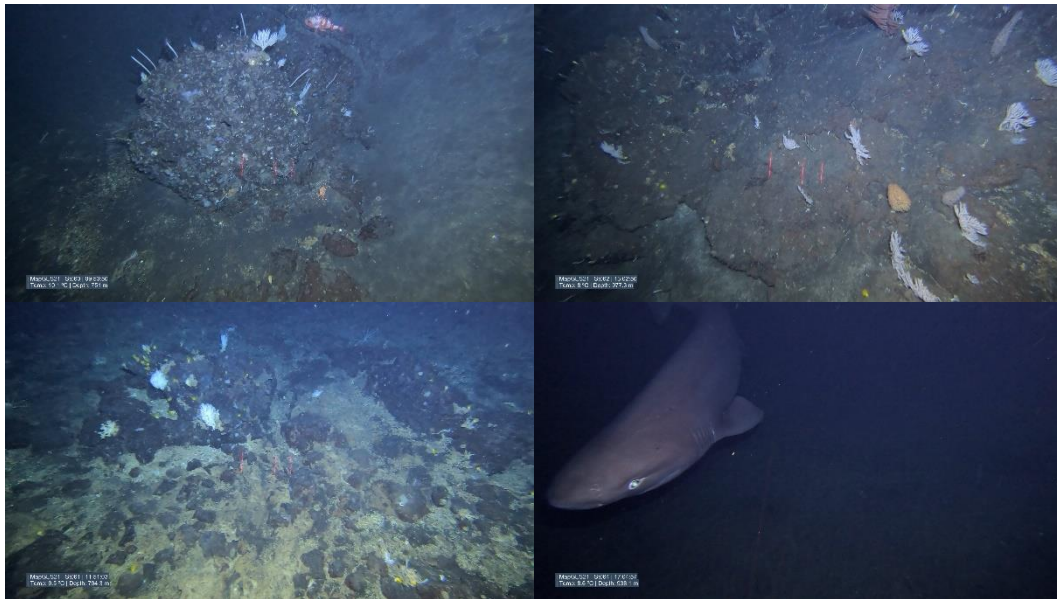


Figure 27. Screenshots taken from the video footage recorded day 11 of MapGES 2021 survey on the northwestern slopes of Faial Island.

Leg 2

Slopes of Corvo Island in the Western Azores

Objective: to conduct a rapid assessment of the deep-sea benthic communities on the slopes of Corvo Island, western Azores. These dives aim to contribute to the overall goal of better understanding the composition, diversity and spatial distribution of the deep-sea benthic fauna in the Azores, the distribution of Vulnerable Marine Ecosystems (VMEs) and commercial fish species and assess their environmental status.

Statistics: We performed 18 dives with the Azor drift-cam down to 1,000 m depth, covering 8 km of the seafloor and producing 20 hours of video footage.

Vessel: FV Gotimar

Dates: 10 - 16 August 2021

Scientific team: Telmo Morato and Carlos Dominguez-Carrió (chief scientists), Sérgio Gomes, Luís Rodrigues, Gerald H. Taranto, Manuela Ramos



Figure 28. The scientific team on FV Gotimar that participated in Leg 2 of MapGES 2021 cruise around Corvo Island.

Highlights:

1. This was the first time that the slopes of Corvo Islands, in the western group of Azores, were explored to reveal their deep-sea benthic biodiversity. It was the second island fully explored with the Azor drift-cam on-board of a small fishing vessel. We were able to perform 18 dives covering 8 km of seafloor.
2. The slopes of Corvo were mostly covered by soft sediments with some basaltic outcrops. In general, we did not observe exuberant benthic communities.
3. In most of the areas explored, the octocorals *Viminella flagellum* (yellow and white morphotypes) and *Acanthogorgia* sp. formed large gardens, together with the demosponge *Phakellia ventilabrum*. Sporadically, within these gardens, we

- also observed small colonies of *Dentomuricea* aff. *meteor* and the “bubblegum” coral *Paragorgia johnsoni*.
4. A large garden formed by the primnoids *Narella bellissima* and *Narella verluysi* and an aggregation of *Eguchipsammia cornucopia* were found in the southwestern slopes of the island.
 5. The slopes around Corvo island hosted several species of long-lived black corals. The species *Elatopathes abietina* was found on most of the dives, forming vast but scattered aggregations, while the species *Stichopathes gravieri*, *Parantipathes hirondelle* and *Leiopathes glaberrima* were occasionally present.

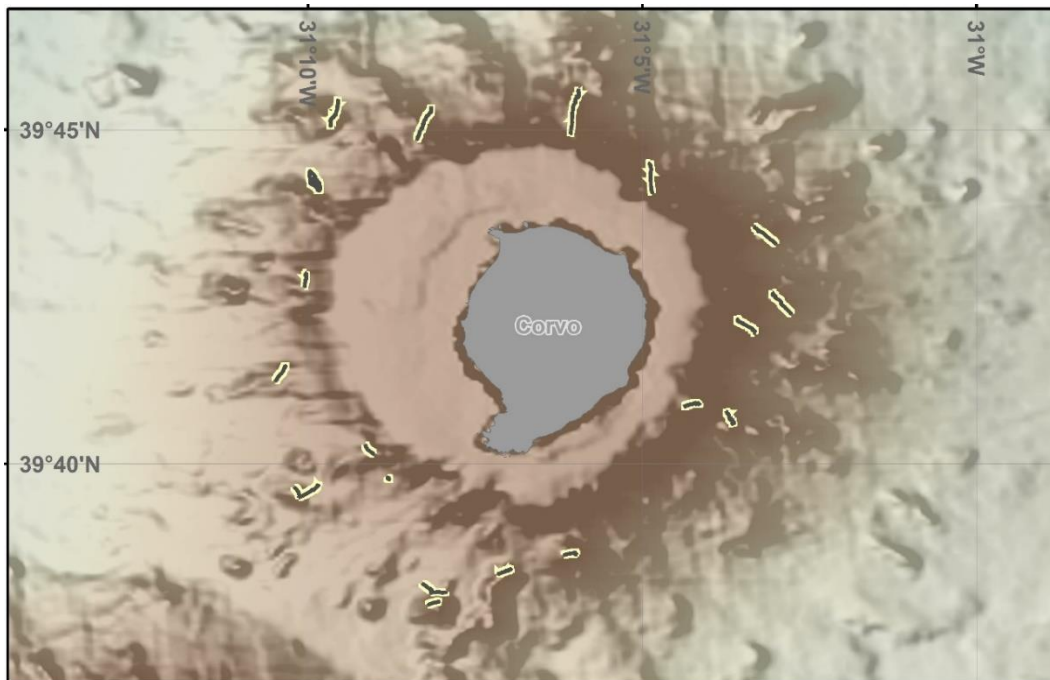


Figure 29. Location of the 18 video transects (black lines) carried out with the Azor drift-cam during Leg 2 of the MapGES 2021 cruise around Corvo Island.

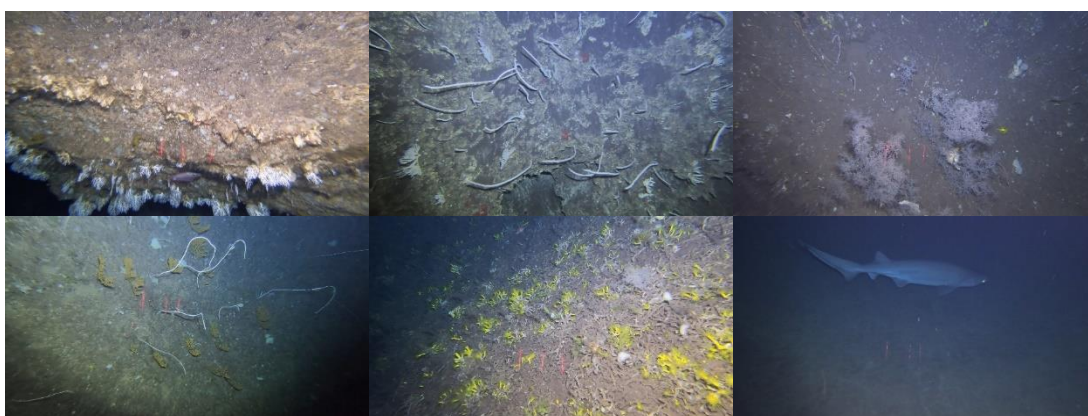


Figure 30. Screenshots taken from the footage recorded during Leg 2 of MapGES 2021 cruise. (a) Small aggregation of the stylasterid *Errina dabneyi*. (b) Dense coral garden composed of the corals *Narella verluysi* and *Narella bellissima*, with some dispersed soft corals of the genus *Pseudoanthomastus*. (c) Aggregation of the black coral *Leiopathes glaberrima* found on shallower areas. (d) An extensive coral garden formed by the whip coral *Viminella flagellum*, together with the gorgonian *Acanthogorgia* sp. and the demosponge *Phakellia ventilabrum*. (e) A coral reef formed by the sclerectinian *Eguchipsammia cornucopia*. (f) One of the several deep-sea sharks found around Corvo island.

Cruise Diary of Leg 2

10 August 2021

We were excited to start exploring the slopes of Corvo island, in the western group, on-board the FV Gotimar. The gear was loaded the previous day to leave Corvo harbor at around 7:30 in the morning in order to explore the NW part of the island. Due to weather conditions, we finished the last dive at around 14:00 and transited back to land. We conducted 4 dives (St. 065-068) between 112 and 774 m depth. Most dives were characterized by sandy bottoms and some basaltic outcrops covered by soft sediments and encrusting sponges. The deepest areas were sparsely colonized by the stylasterid *Errina dabneyi* and some occasional whip corals of the species *Viminella flagellum*. The common motile fauna included the starfish *Peltaster placenta*, the commercial important fishes *Helicolenus dactylopterus*, *Beryx decadactylus*, and *Conger conger*, a shoal of *Hoplostethus mediterraneus* and small fishes from the Macrouridae family. In the shallowest areas, we observed some aggregations of the black coral *Elatopathes abientina* and some solitary colonies of *Eguchipsammia cornucopia*. The most abundant coral species were *Viminella flagellum* (yellow and white morphotypes) together with *Acanthogorgia* sp., and some occasional *Errina dabneyi*.

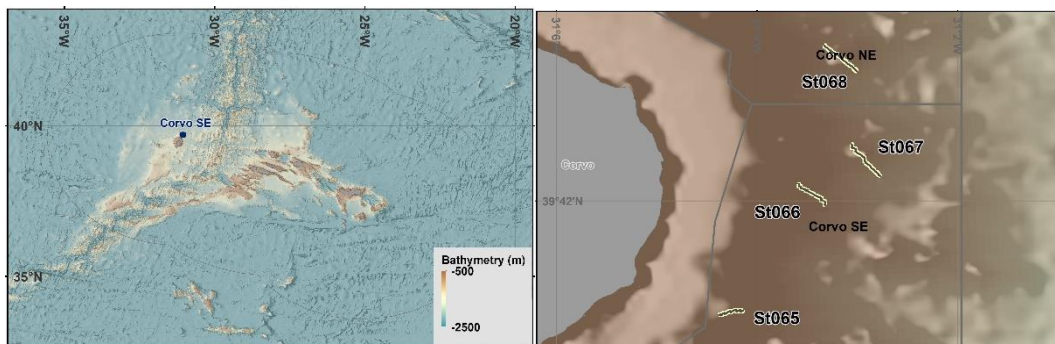


Figure 31. Location of the video transects conducted with the Azor drift-cam during day 1 of Leg 2 of MapGES 2021 in northwestern slopes of Corvo Island.

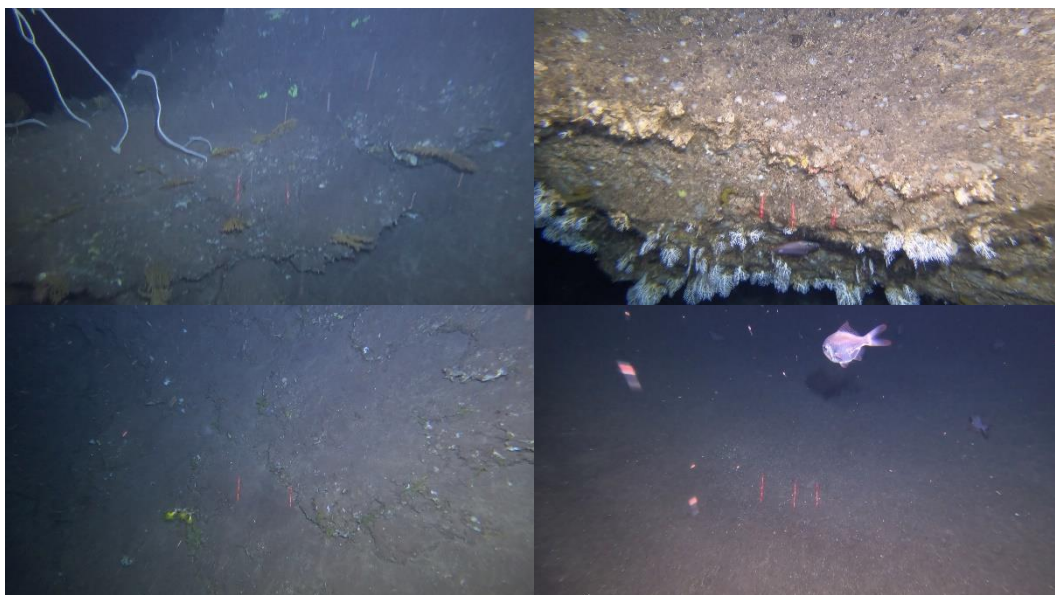


Figure 32. Screenshots extracted from the video footage recorded with the Azor drift-cam during day 1 of Leg 2 of MapGES 2021 on the northwestern slopes of Corvo Island.

11-12 August 2021

The weather conditions were not ideal to operate the Azor drift-cam from a small fishing vessel such as Gotimar. With moderate winds and large swell, the drift was too fast preventing the drift-cam to reach the seafloor. During these two days, we explored the Corvo Island by foot, making a portion of the hiking trail Cara do Índio on the 11th of august and the tour of Caldeirão on the 12th.



Figure 33. Exploring Corvo island by foot.

13 August 2021

The weather conditions remained poor during the morning. With a slight decrease of the wind speed and swell, we decided to try our luck and left Corvo harbor at around 13:00 to explore the SE slopes of Corvo. A total of 4 dives (St. 069-072) were performed in a depth range between 472 and 691 m. The bottoms were mainly characterized by soft sediments, with occasional basaltic outcrops and coral rubble, with the exception of the last dive, where we found hard substrates. We sighted several black coral species in the deepest areas, including scattered *Elatopathes abietina*, *Parantipathes hirondelle* and *Stichopathes gravieri*, along with large demosponges of the genus *Geodia* sp. and *Stylocordyla pellita* and other encrusting and glass sponges. Other coral species found at these depths included solitary colonies of the gorgonian *Paragorgia johnsoni*, small aggregations of *Acanthogorgia* sp., and dispersed soft corals. In the shallower areas, the most common coral species was *Viminella flagellum* together with some scleractinians *Enallopsammia rostrata*, the black coral *E. abientina* and the demosponge *Phakellia ventilabrum*. The motile fauna was represented by fishes of the Macrouridae family and the commercial species *Helicolenus dactylopterus* and *Hoplostethus mediterraneus* in the deepest areas. After the dives, we sailed back to land at around 20:00.

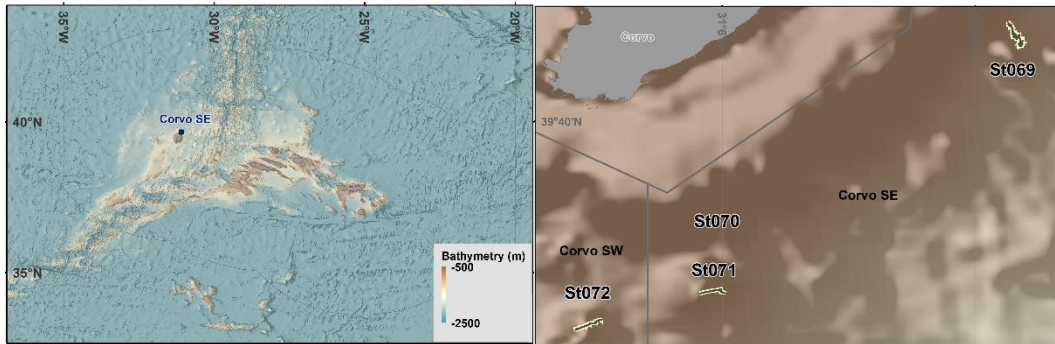


Figure 34. Location of the video transects conducted with the Azor drift-cam during day 2 of Leg 2 of MapGES 2021 in southeastern slopes of Corvo Island.

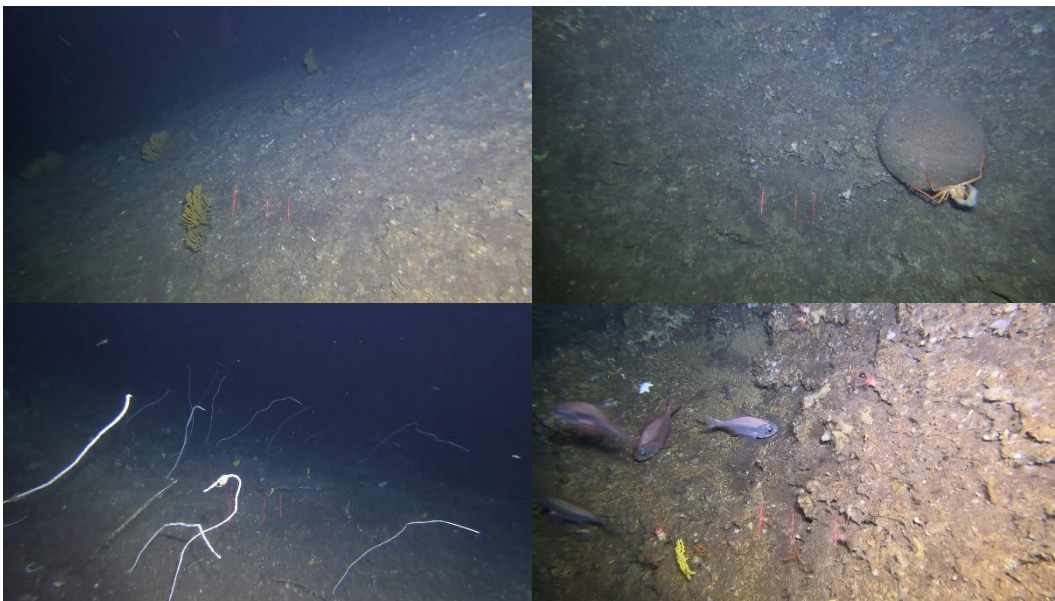


Figure 35. Screenshots extracted from the video footage recorded with the Azor drift-cam during day 2 of Leg 2 of MapGES 2021 in the southeastern slopes of Corvo Island.

14 August 2021

We left Corvo harbor at around 08:00 to explore the NE slopes of Corvo. The 4 dives completed (St. 073-076) ranged from 178 to 975 m depth. The bottoms observed were diverse, shifting from areas covered with soft sediments with occasional patches of coral rubble or basaltic outcrops to very steep vertical walls with small encrusting sponges. The last dive, which was also the deepest, had different fauna from the other dives, especially the bird's nest sponge *Pheronema carpenteri* and some xenophyophores (*Syringamina fragillissima*) on soft substrate. The fauna in the other dives was more similar. In the shallower areas, we observed aggregations of the whip coral *Viminella flagellum* (white and yellow morphotypes) together with the gorgonian *Acanthogorgia* sp., the black coral *Elatopathes abietina* and the sponges *Phakellia ventilabrum* and *Haliclona implexa*. Occasionally, some colonies of *Dentomuricea* aff. *meteor* and *Enalopsammia rostrata* appeared mixed in these gardens. The deepest areas were characterized by the same kind of aggregations, although only with the white morphotype of *Viminella flagellum*, a few small colonies of the gorgonian cf. *Paragorgia johnsoni* and the black coral *Parantipathes*

hirondelle. The motile fauna found at greater depths was composed mainly of anguilliform fishes, frog fish *Chaunax* sp. and a small shoal of *Hoplostethus mediterraneus*, while the species *Helicolenus dactylopterus* was found in most depths. We also spotted several species of elasmobranchs, including the ray *Tetronarce nobiliana* and a shark of the genus *Daenia*, and some occasional sea urchins of the species *Echinus melo* and *Cidaris cidaris*. After these dives, we started sailing back to land at around 17:00.

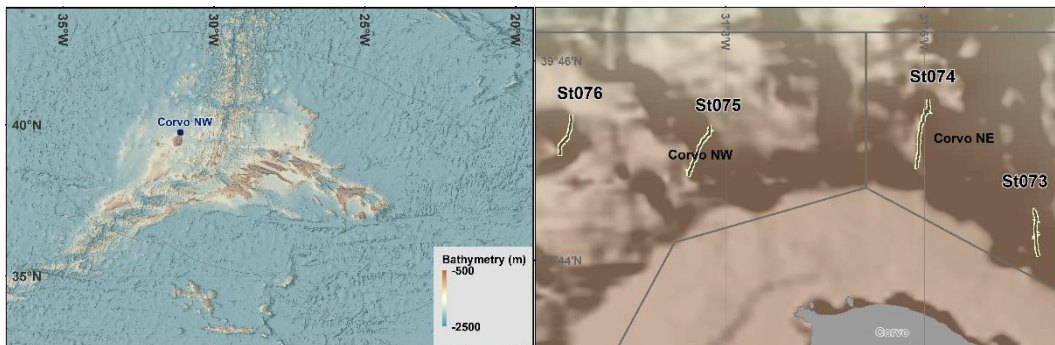


Figure 36. Location of the video transects conducted with the Azor drift-cam during day 3 of Leg 2 of MapGES 2021 in northeastern slopes of Corvo Island.

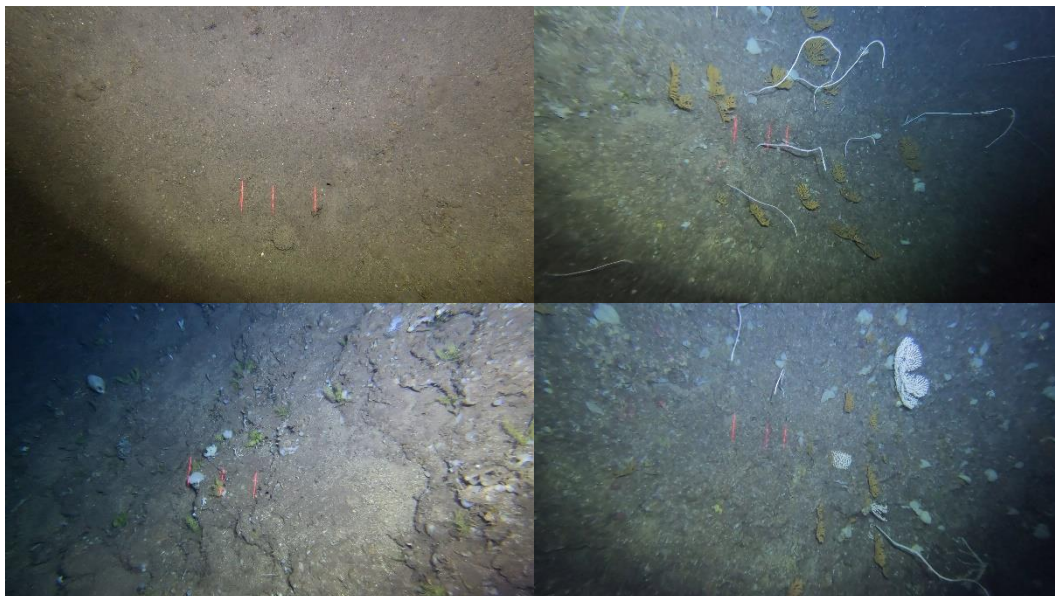


Figure 37. Screenshots extracted from the video footage recorded with the Azor drift-cam during day 3 of Leg 2 of MapGES 2021 in the northeastern slopes of Corvo Island.

15 August 2021

We left the harbor at around 08:00 to explore the SW slopes of Corvo. A total of 6 dives were performed (St. 077-082) between 272 and 858 m depth. The seafloor was diverse, from soft and sandy bottoms to hard substrates covered with coral rubble or soft sediments, to basaltic outcrops and vertical walls. The deepest parts were characterized large aggregations of *Narella verluysi* and *Narella bellissima*, together with soft corals and several colonies of the black coral *Parantipathes hirondelle*. The gorgonians *Acanthogorgia* sp. and *Viminella flagellum* (white and yellow morphotypes) were found in all depths forming larger aggregations on shallower areas. At those depths, were also encountered species of the black corals

Elatopathes abietina and *Leiopathes glaberrima* and the scleractinians *Dendrophyllia cornigera* and *Eguchipsammia cornucopia*. The sponges were more abundant in the shallower areas and mainly *Phakellia ventilabrum* and *Haliclona implexa*. The motile fauna encountered in these dives were mainly commercial fishes, like *Helicolenus dactylopterus*, *Hoplostethus mediterraneus* and *Conger conger*, dispersed starfish *Peltaster placenta*, and a *Dipturus intermedius* ray. We finished the day at around 18:00 and sailed back to land.

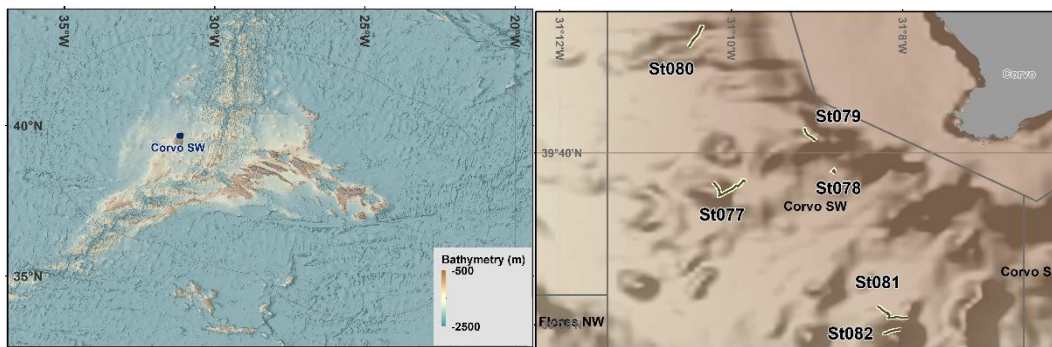


Figure 38. Location of the video transects conducted with the Azor drift-cam during day 4 of Leg 2 of MapGES 2021, in southwestern slopes of Corvo Island.

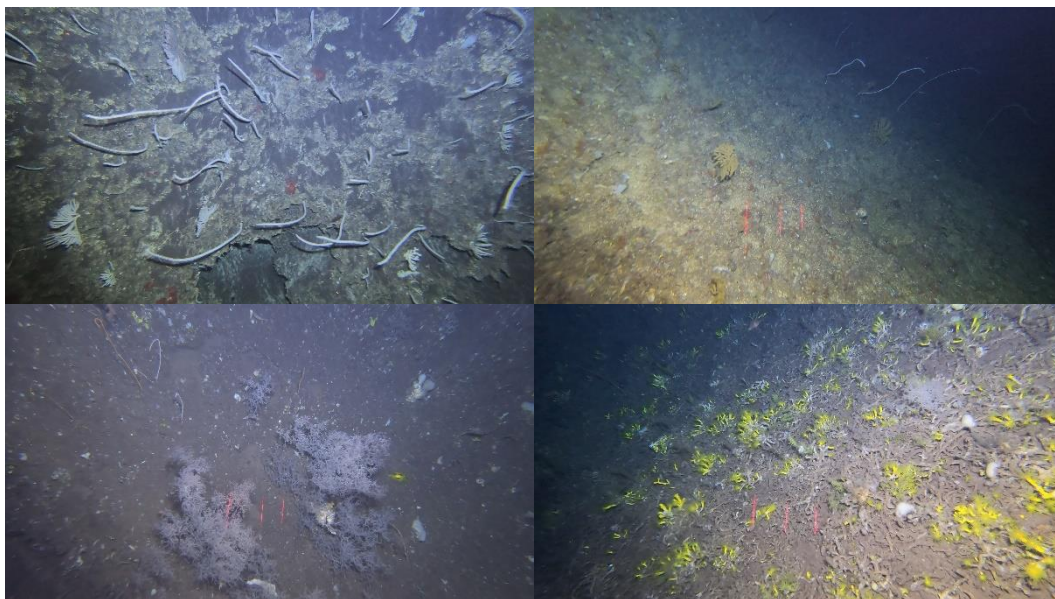


Figure 39. Screenshots extracted from the video footage recorded with the Azor drift-cam during day 4 of Leg 2 of MapGES 2021, in the southwestern slopes of Corvo Island.

16 August 2021

We left Corvo harbor at around 08:00 to explore the NW slopes of Corvo. A total of 2 dives were performed (St. 083-084), with one dive aborted because the structure got caught on a rocky outcrop. It took a great deal of experience from the Master Pereira, a change in tide and 3 hours of waiting to get the Azor drift-cam released. The first dive (and the only valid) was performed between 449 and 515 m depth. In this station, we found soft bottoms with some patches of coral rubble and sparse and dispersed fauna, mainly the black coral *Elatopathes abietina* together with some demosponges like *Phakellia ventilabrum* and the genus *Haliclona*. It was a very poor

area, except for a small coral garden composed of the whip coral *Viminella flagellum* and *Acanthogorgia* sp. The motile fauna was represented by some fishes, like *Helicolenus dactylopterus*, *Lepidorhombus whiffiagonis* and a shark of the species *Hexanchus griseus*. We arrived back to land at around 15:00.

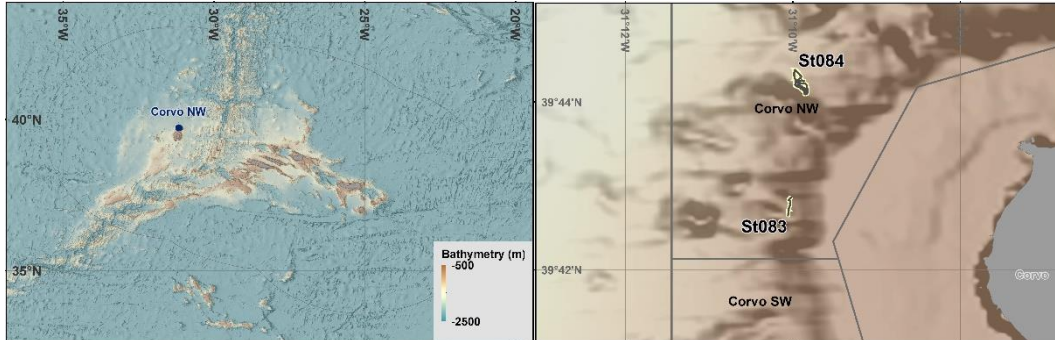


Figure 40. Location of the video transects conducted with the Azor drift-cam during day 5 of Leg 2 of MapGES 2021, in northwestern slopes of Corvo Island.

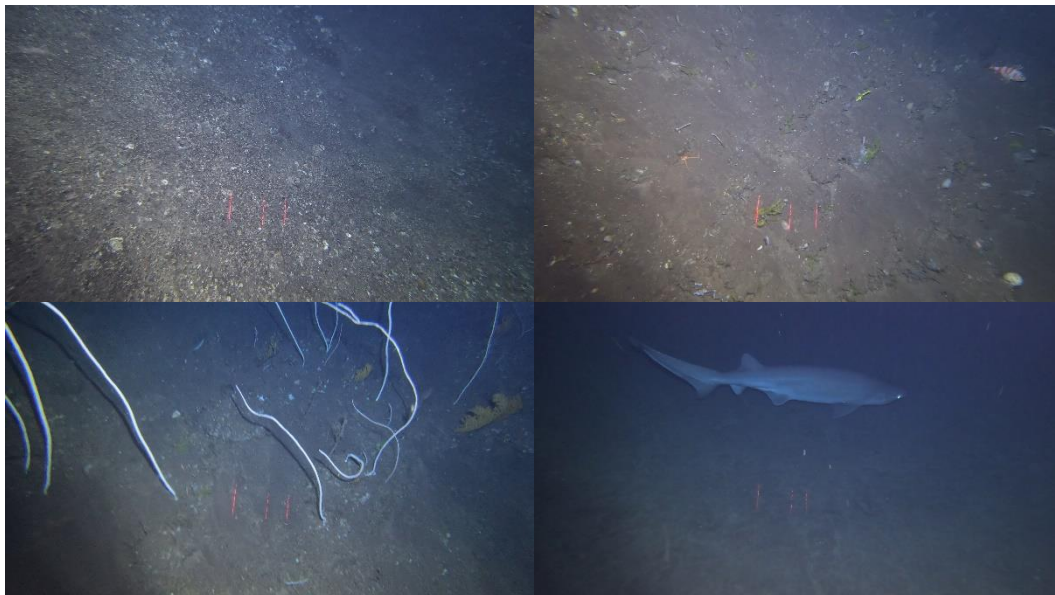


Figure 41 Screenshots extracted from the video footage recorded with the Azor drift-cam during day 5 of Leg 2 of MapGES 2021, in the northwestern slopes of Corvo Island.

Leg 3

Slopes of the islands of Faial, Pico and São Jorge on board of the research vessel Arquipélago

Objective: to conduct a rapid assessment of the deep-sea benthic communities dwelling on the slopes of the Islands of Faial, Pico and São Jorge on board the research vessel Arquipélago. These dives aim to contribute to the overall goal of better understanding the composition, diversity, and spatial distribution of deep-sea benthic communities in the Azores, the distribution of Vulnerable Marine Ecosystems (VMEs) and commercial fish species and assess their environmental status.

Statistics: We performed 68 dives, out of 71 stations, with the Azor drift-cam down to 1000 m depth, covering 48 km of the seafloor and producing 68 hours of video footage.

Vessel: RV Arquipélago

Dates: 25 August-15 September 2021

Scientific team: Carlos Dominguez-Carrió (chief scientist), Sérgio Gomes, Luís Rodrigues, Gerald H. Taranto, Guilherme Gonçalves



Figure 42. Scientific team and crew of the RV Arquipélago that participated in Leg 3 of the MapGES 2021 cruise.

Highlights:

1. Among the vast range of coral species present in the areas explored during leg 3 of MapGES 2021, an impressive and solitary black coral of the genus *Bathypathes* was observed in Baixo de São Mateus. A vast aggregation of the bird's nest sponge *Phoronema carpenteri* was discovered at the deepest areas of Baixo de São Mateus.
2. An outstanding and extense reef of the scleractinian coral *Eguchipsammia cornucopia* was spotted growing on dead coral framework in São Jorge W (Rosais). A large aggregation of the gorgonian *Acanthogorgia* spp., and massive specimens of *Callogorgia verticillata* were also spotted in this area.
3. Throughout the dives conducted during this leg, many commercially important fish species were commonly recorded, such as the bluemouth rockfish (*Helicolenus dactylopterus*), orange roughy (*Hoplostethus atlanticus*), silver roughy (*Hoplostethus mediterraneus*), and Conger (*Conger conger*). This information supports that the area south of Faial island is an important deep-sea area.
4. The deep-sea fish *Grammicolepis brachiusculus* was observed for the first time during a MapGES survey in the Azores.
5. The seabed was occasionally formed by lava pillows, an interesting geological feature suggesting several underwater volcanic eruptions around Faial.

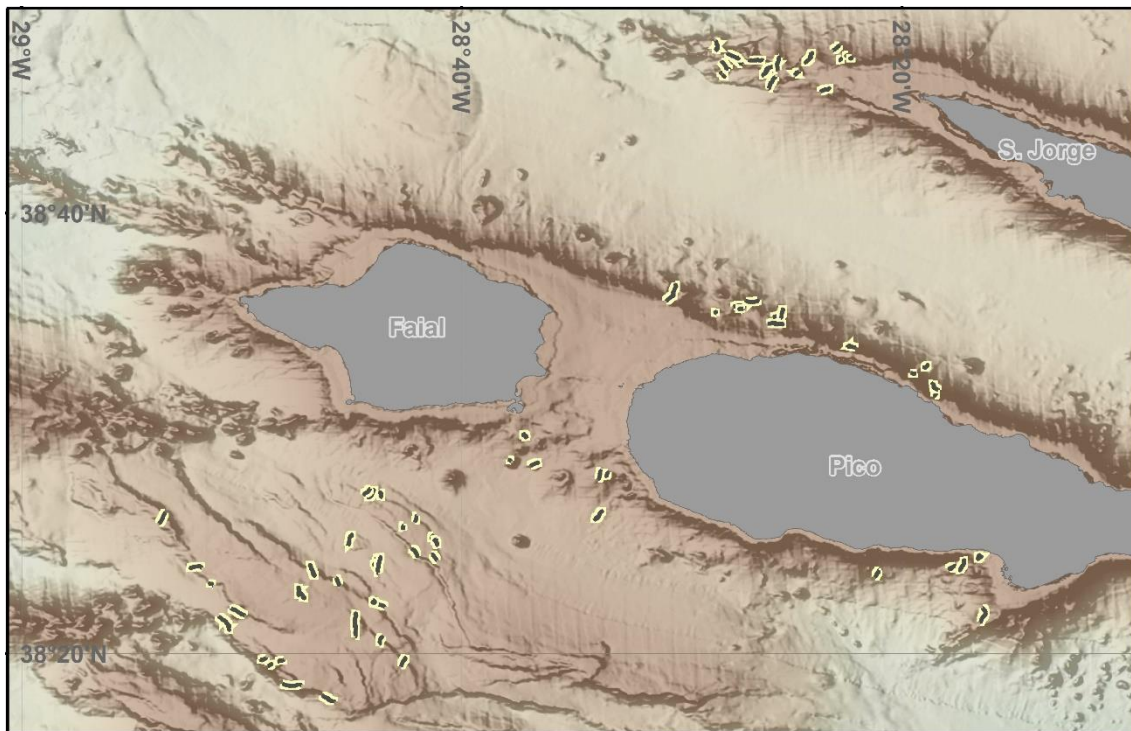


Figure 43. Location of the 68 video transects (black lines) carried out with the Azor drift-cam during Leg 3 of MapGES 2021.

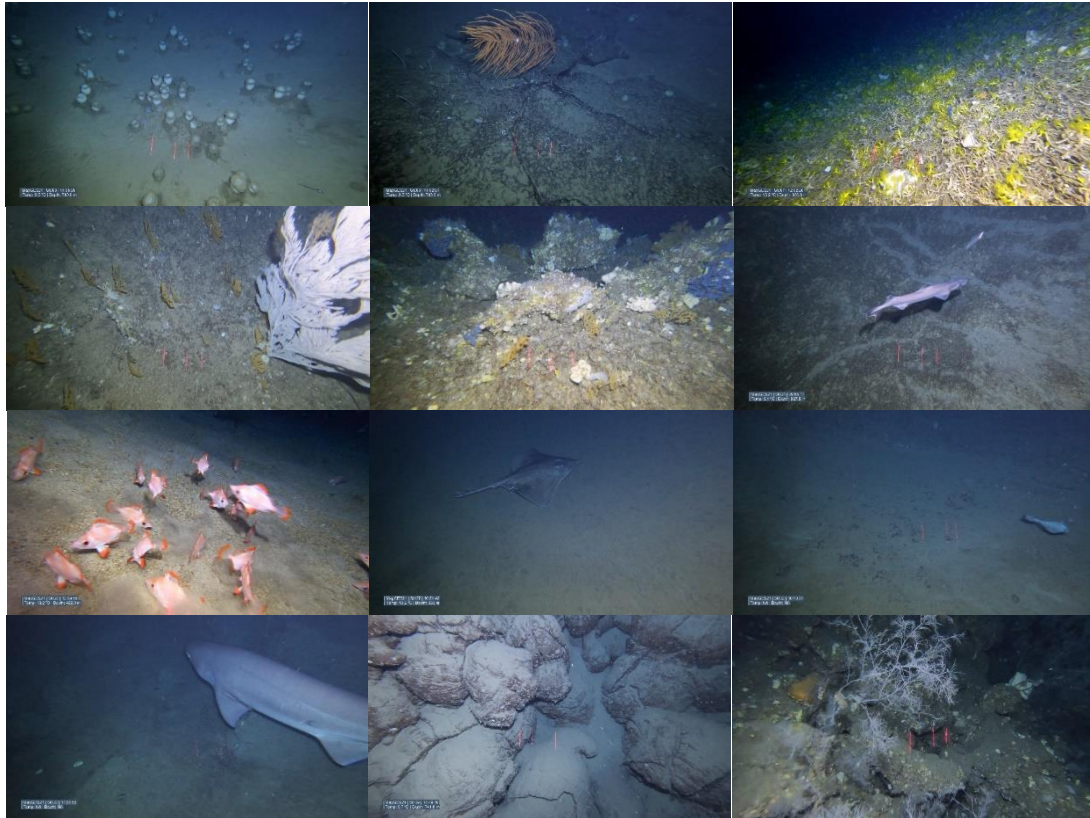


Figure 44. Screenshots taken from the footage recorded during Leg 3 of MapGES 2021 cruise. (a) Aggregation of the “bird’s nest” sponge *Pheronema carpenteri*. (b) Impressive exemplar of a black coral of the genus *Bathypathes*. (c) Outstanding aggregation *Eguchipsammia cornucopia*. (d) Patches of the coral *Acanthogorgia* spp., and one massive *Callogorgia verticillata*. (e) Basaltic outcrop covered with sponges of the species *Macandrewia azorica*, *Leiodermatium* sp., and the gorgonian *Acanthogorgia* spp. (f) A shark of the genus *Deania* gently swimming above soft bottoms. (g) Small shoal of *Capros aper*. (h) A ray of the species *Dipturus intermedius* laying in the sand (i) A very uncommon sight of the fish species *Grammicolepis brachiusculus*. (j) Spot of a big sixgill shark (*Hexanchus griseus*). (l) Lava pillows characterize the seabed. (m) A black coral of the species *Antipathella subpinnata* apparently relatively damaged.

Cruise Diary of Leg 3

25 August 2021

Because the crew of RV Arquipélago was still on strike for night shifts, we could only operate the vessel between 07:00 to 22:00. The first day of Leg 3 of MapGES 2021 cruise aimed to explore the slopes of southern Pico Island, close to Lajes. We left Horta at around 07:30 and performed 6 successful dives (St. 085-089), the latest being shorter because it was time to return to port. We surveyed areas characterized by a high sedimentation across all surveyed depths (45-845 m). The 4th dive (St. 088) was done in much shallower depths (45-110m) upon request of the Portuguese Hydrographic Institute. During their coastal multibeam surveys they detected some gas bubbles on the sonars and asked to check if we could find the origin of such emissions. All other dives covered depths between 360 and 845m, and recorded relatively poor faunal assemblages. The deepest sections explored revealed barren sandy substrates, with only occasional *Hyalonema* (*Cyliconema*) *thomsonis* and xenophyophores. We also covered upslope sections where pillow lavas formed steep slopes on which few species occurred on low abundances. Only the glass sponges *Farrea occa* and *Aphrocallistes beatrix*, some crinoids *Cyathidium*

foresti concealed under overhangs and occasional soft corals of the genus cf. *Gersemia* sp. had some relevance. This was a particularly irregular terrain, which made the navigation of the camera system quite difficult. Silver roughy *Hoplostethus mediterraneus* and mora fish *Mora moro* were also spotted. Near 450 m depth, the benthic community became a richer, with a sponge dominated community colonizing the basalts surrounded by sediments and unconsolidated substrates. We mostly encountered small or encrusting sponges, but occasional demosponges *Characella pachastrelloides*, *Petrosia crassa*, *Neophrissospongia nolitangere* and *Macandrewia azorica* were also part of this assemblage. A few colonies of the whip coral *Viminella flagellum* were also spotted in shallower sectors of the slope. Shoals of boarfish *Capros aper* and cf. *Epigonus* sp. were observed, as well as blackspot seabreams *Pagellus bogaraveo* and rosy dory *Cyttopsis rosea*. Deep-sea sharks were also seen, such as a kitefin *Dalatias licha*. We started transiting back to Horta at 19:00 and arrived at port at 21:00.

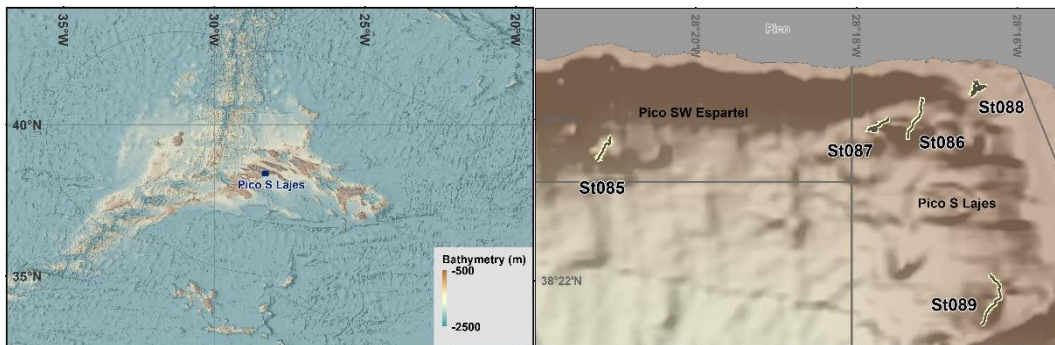


Figure 45. Map showing the dives conducted on the first day 1 of Leg 3 of MapGES 2021 cruise in the slopes of southern Pico Island, close to Lajes.

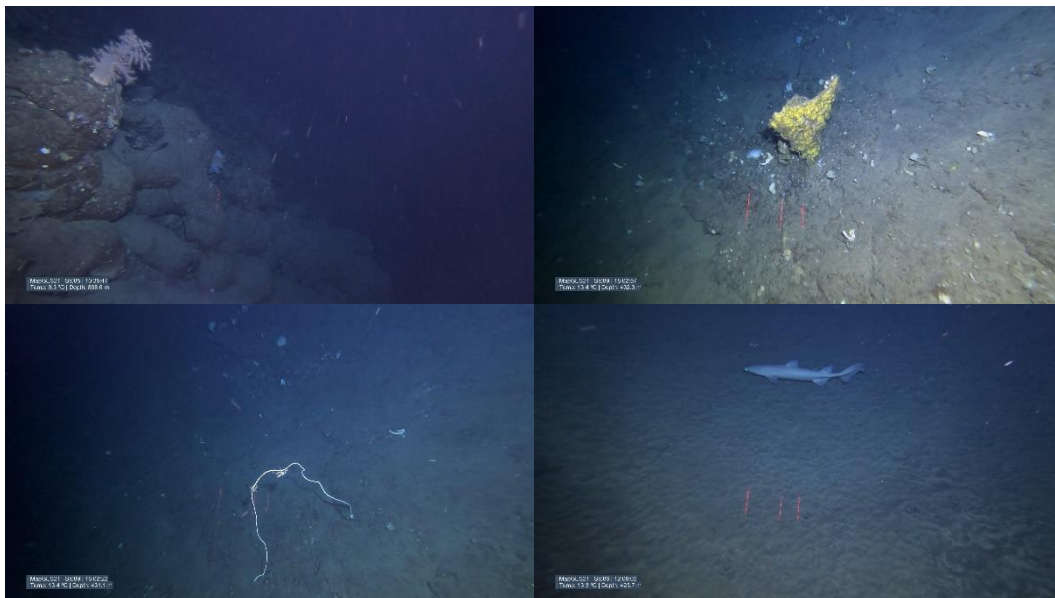


Figure 46. Screenshots taken from the video footage recorded during day 1 of Leg 3 of MapGES 2021 cruise in the slopes of southern Pico Island, close to Lajes.

26 August 2021

We left Horta harbour at around 07:30 to explore Baixo de São Mateus bank, south of Faial Island, performing 6 successful dives (St. 090-095). Despite covering a relatively narrow depth gradient (700-860 m), the different substrates observed

held different faunal compositions, forming interesting communities. During the day the drifts were good overall, with the only problem being the structure moving backwards in the first two dives. Soft and unconsolidated substrates, either originated from sand or finer sediments, dominated in this area. Here, we consistently observed massive fields of the bird's nest sponge *Pheronema carpeniteri* in high abundances, covering large sections of the seafloor. Occasionally, other glass sponges were also observed, such as *Hyalonema (Cyliconema) thomsonis* and *Farrea occa*. Some eel-like fishes, sea-urchins and deep-sea sharks *Deania* sp. composed most of the motile fauna observed. When upslope sections appeared, the benthic community rapidly shifted to a different composition, where the primnoid corals *Narella versluysi* and *Narella bellissima* were dominant, with other more sporadic gorgonians, including *Acanthogorgia* spp. and *Callogorgia verticillata* and the hydrocoral *Errina dabneyi*, this latter forming occasional patches. Several glass sponges, such as *Aphrocallistes beatrix*, *Farrea occa*, *Pheronema carpeniteri* and *Regadrella phoenix*, were quite common along the explored slopes. When flat or outcropped basalts appeared, these were usually colonized by a small plexaurid corals in patchy distributions, but relatively abundant. We also drifted over an impressive and solitary black coral colony of the genus *Bathypathes*. After six dives, we started sailing back to land at around 19:00.

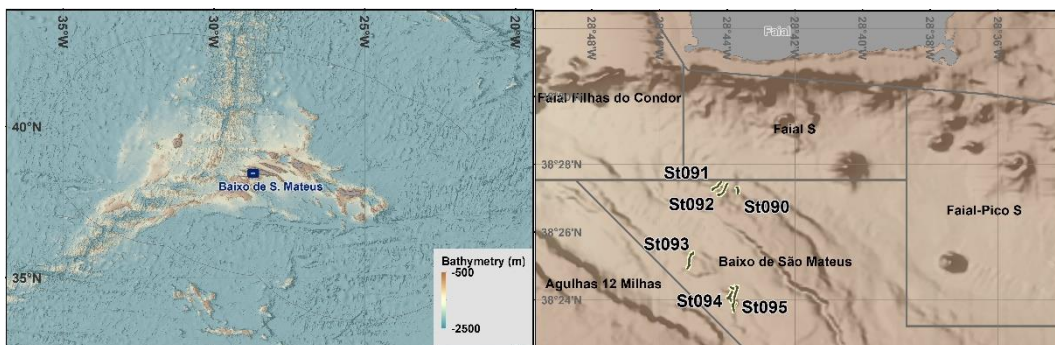


Figure 47. Map showing the dives conducted during day 2 of Leg 3 of MapGES 2021 cruise in Baixo de São Mateus, south of Faial Island.



Figure 48. Screenshots taken from the video footage recorded during day 2 of Leg 3 of MapGES 2021 cruise in Baixo de São Mateus, south of Faial Island.

27 August 2021

The surveys with the Azor drift-cam on board the RV Arquipélago were cancelled because of bad weather conditions.

28-29 August 2021

Because of the crew strike for night shifts, which limited the number of stations that could be conducted during the MapGES 2021 survey, we decided not to work during the weekends.

30 August 2021

We left Horta harbour at around 07:30 to explore Ponta dos Rosais at the western tip of São Jorge Island and managed to conduct 6 successful dives (St. 096-101) across depths between 270 and 850m. The deepest areas surveyed were mostly flat and covered in fine sediments, only hosting occasional patches of the glass sponges *Pheronema carpenteri* and *Hyalonema* (*Cyliconema*) *thomsonis* with increasing densities as we moved up the slope. Bluemouth rockfish *Helicolenus dactylopterus*, silver roughy *Hoplostethus mediterraneus* and a small deep-sea shark from the genus *Deania* were observed near these sectors. At around 700 m depth, sedimentary grounds were still the prevalent type of substrate, hosting little benthic fauna, with the exception of a few demosponges *Macandrewia azorica* and a small aggregation of the sea urchin *Cidaris cidaris* and a solitary alfonsino *Beryx decadatylus*. At around 600 m depth, the hard substrate began bearing a little more fauna. One of the slopes was characterized by a few large colonies of the primnoid corals *Callogorgia verticillata* and *Paracalyptrophora josephinae* and many severely impacted black corals of the species *Leiopathes glaberrima*. As we began covering shallower sectors characterized by basaltic outcrops, diversity and abundances rose considerably, where different benthic communities could be observed. One of them was clearly dominated by sponges, with many different encrusting species, but also large demosponges such as *Macandrewia azorica*, *Neophrissospongia nolitangere*, *Characella pachastrelloides* and *Petrosia* sp.. Within this community, coral species were also seen, such as sporadic colonies of *Acanthogorgia* spp., *Viminella flagellum* and *Errina dabneyi*. In other areas, coral abundances were higher, with *Acanthogorgia* spp. forming a coral garden, together with occasional colonies of *Paracalyptrophora josephinae* and *Dentomuricea* aff. *meteor*. The crab *Paromola cuvieri* was frequently observed up until these depths. The shallower areas surveyed were covered by dense beds of the scleractinian coral *Echuchipsammia cornucopia*. Despite some spots of these aggregations being formed by partially dead corals, most of the community appeared to be quite healthy, covering large portions of the explored mound. A small, white scleractinian coral was also seen within this aggregation, as well as the sea urchin *Echinus melo*. After six successful dives we started sailing back to land at around 19:30 so we could get back to harbour before the start of the strike at 22:00.

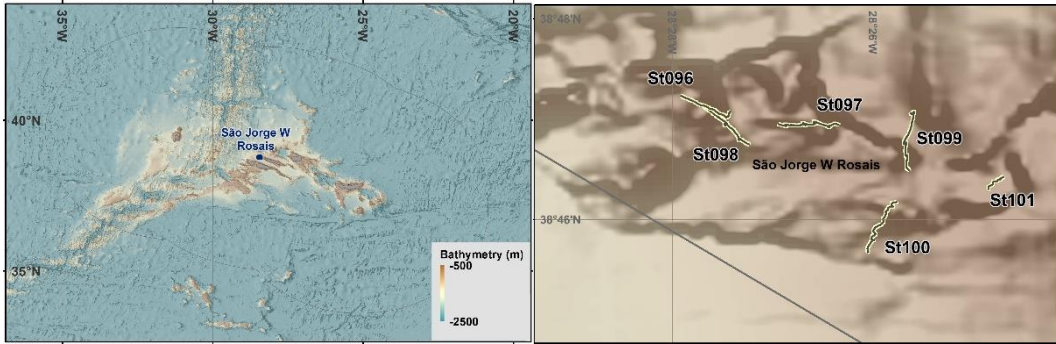


Figure 49. Map showing the location of the dives performed during day 3 of MapGES 2021 cruise on Ponta dos Rosais at the western tip of São Jorge Island.

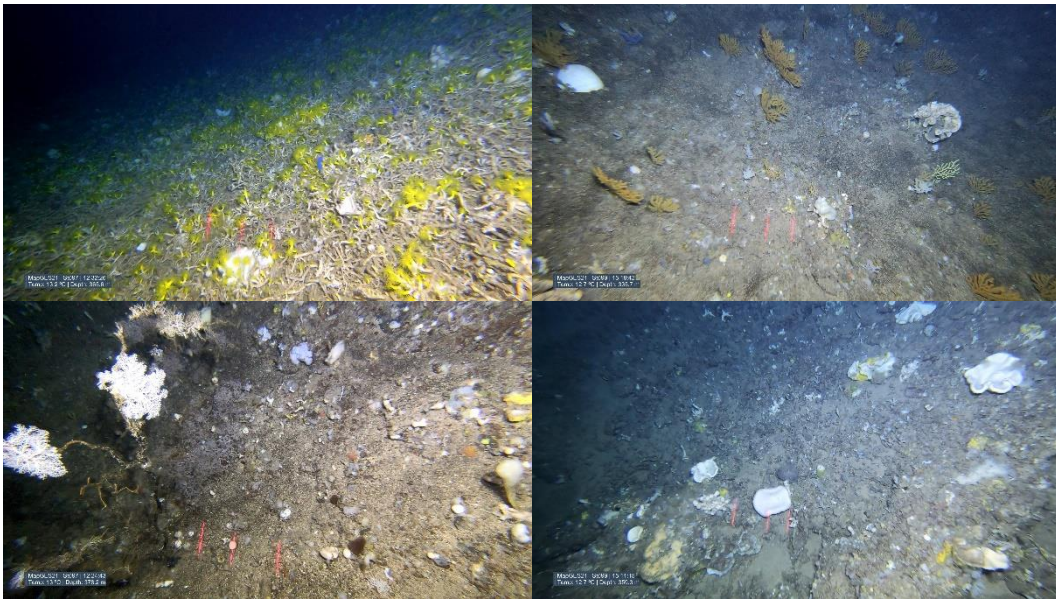


Figure 50. Screenshots taken from the video footage recorded during day 3 of Leg 3 of MapGES 2021 cruise in Ponta dos Rosais at the western tip of São Jorge Island.

31 August 2021

We left Horta harbor at around 07:30 to continue the exploration of Ponta dos Rosais at the western tip of São Jorge Island. We performed a total of five dives (St. 102- 106) across depths between 181 and 930m. One of the dives was aborted (St. 103) due to lost live view. The deepest dive reached a maximum depth of around 930 m, while the others were performed in a depth range between 181 and 646 m. The first dive was mainly characterized by hard substrates covered with soft sediments, patches of coral rubble and loose pebbles. It had practically no sessile fauna apart from some encrusting sponges, the scleractinian coral *Leptopsammia formosa* and xenophyophores. Regarding the motile fauna, it was possible to identify several sharks, including *Hexanchus griseus* and *Dalathias licha*, fishes from Macrouridae family, as well as *Hoplostethus mediterraneus*, some echinoderms, such as the sea urchin *Cidaris cidaris* and crinoids. On the other dives, the deepest areas were mainly formed by soft sediments with patches of loose pebbles with dispersed scleractinians of the genus *Flabellum* and small sponges. As we ascent, the seafloor became rockier and irregular, with hard substrates completely colonized by encrusting and small sponges. In these shallower areas, we were able to observe a large coral garden formed by the species *Acanthogorgia* sp., the yellow morphotype of the whip coral *Viminella flagellum*, some large colonies of the primnoid *Paracalyptophora josephinae* and small (and less abundant) *Dentomuricea* aff. *meteor*. Despite this large aggregation, sponges were the most abundant and diverse group, and besides the great variety of encrusting sponges, we were able to identify *Characella pachastrelloides*, *Macandrewia azorica*, *Haliclona implexa*, *Neophrissospongia nolitangere*, *Phakellia ventilabrum* and both white and blue morphotypes of *Leiodermatium* sp. The irregular seafloor morphology was a refuge for several fishes, including commercial species like the bluemouth rockfish *Helicolenus dactylopterus*, the silver roughy *Hoplostethus mediterraneus*, *Phycis phycis* and *Pontinus kuhlii*. After the dives, we started sailing back to land at around 19:30 so we could get back to the harbor before 22:00.

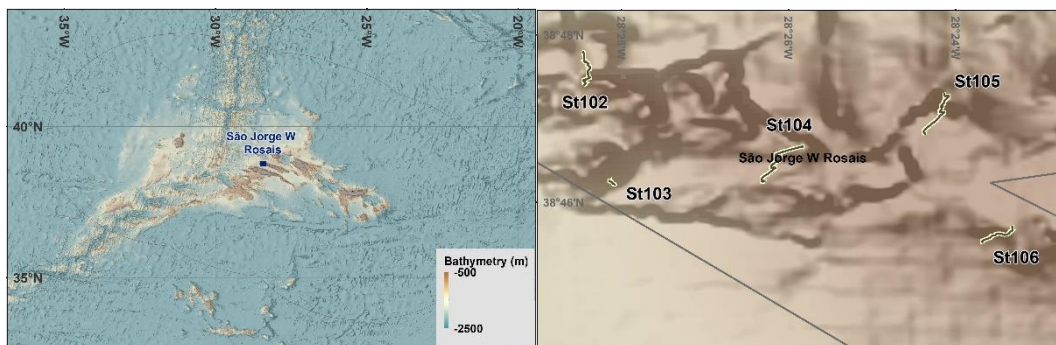


Figure 51. Map showing the location of the dives performed during day 4 of MapGES 2021 cruise on the Ponta dos Rosais at the western tip of São Jorge Island.

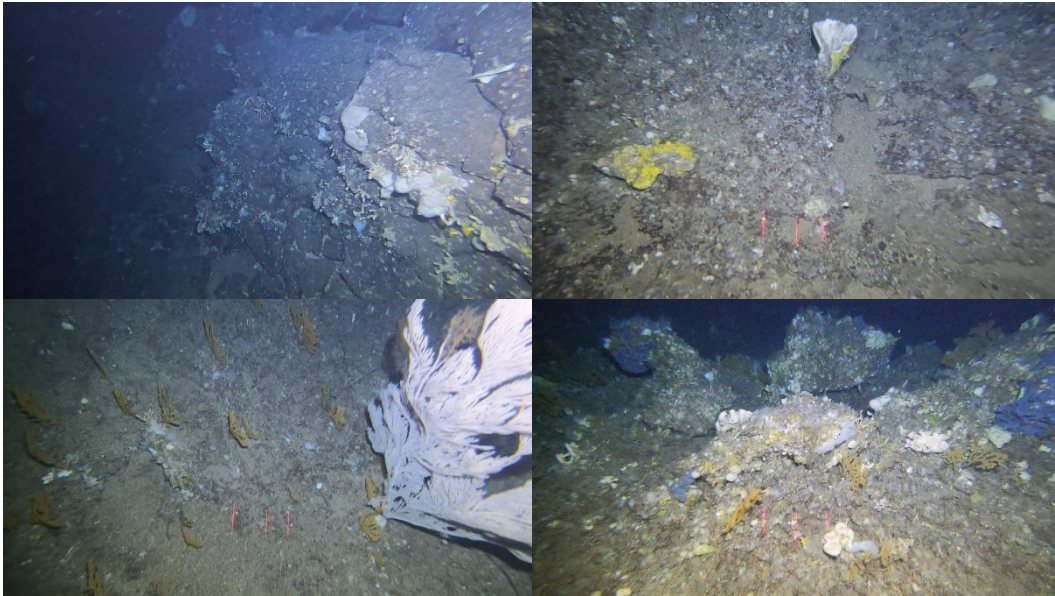


Figure 52. Screenshots taken from the video footage recorded during day 4 of Leg 3 of MapGES 2021 cruise in Ponta dos Rosais at the western tip of São Jorge Island.

1-2 September 2021

The surveys with the Azor drift-cam on board the RV Arquipélago were cancelled because of bad weather conditions.

3 September 2021

We left Horta harbor at around 07:30 to explore Baixo São Mateus and Agulhas 12 milhas bank, south of Faial. We performed 8 dives (St. 107-114) between 639 and 809 m depth. In general, no technical problems were reported besides a change of drift during the last dive (heading south instead of southeast, as desired). Throughout all dives, the seabed was mainly composed of soft sediment, sometimes muddy at greater depths, and generally with the presence of sporadic pebbles, basaltic outcrops and even covered with coral rubble. The soft bottoms were mainly inhabited with occasional sea urchins of the family Echinothuriidae and the species *Echinus melo*, and casual aggregations of the bird's nest sponge *Pheronema carpenteri*. At greater depths, the hard substrates usually hosted the sponge *Macandrewia azorica*, and the glass sponge *Farrea occa*, displaying a wide distribution along the slope, increasing in shallower depths. At shallower areas, gorgonians of the genus *Acanthogorgia* sp., and the sponge *Characella pachastrelloides* were a regular sighting. Some other corals were observed, such as the hydrozoan *Pliobothrus symmetricus*, soft corals, white and red morphs of *Paragorgia johnsoni*, the primnoid *Narella bellissima*, and at sandy bottoms the hydrozoan *Lytocarpia myriophyllum*. Some other sponges included individuals of the genus *Geodia* and *Petrosia crassa*. Motile fauna consisted in the presence of crustaceans of the species *Paromola cuvieri* and *Bathynectes maravigna* mainly at the deeper areas, along with a relatively high abundance of the frog fish of the genus *Chaunax*, some *Conger conger* and the commercially important bluemouth rockfish *Helicolenus dactylopterus*. After these successful dives, we started sailing back to land at around 19:00.

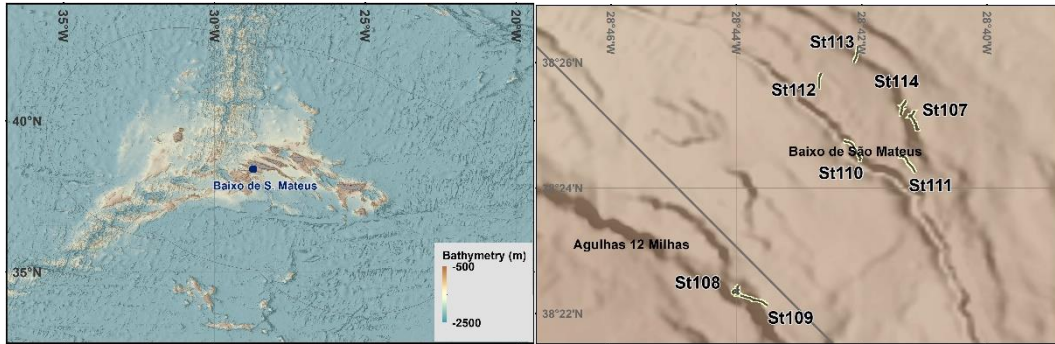


Figure 53. Map showing the dives conducted on day 5 of Leg 3 of MapGES 2021 cruise in Baixo São Mateus and the Agulhas 12 milhas bank, south of Faial Island.

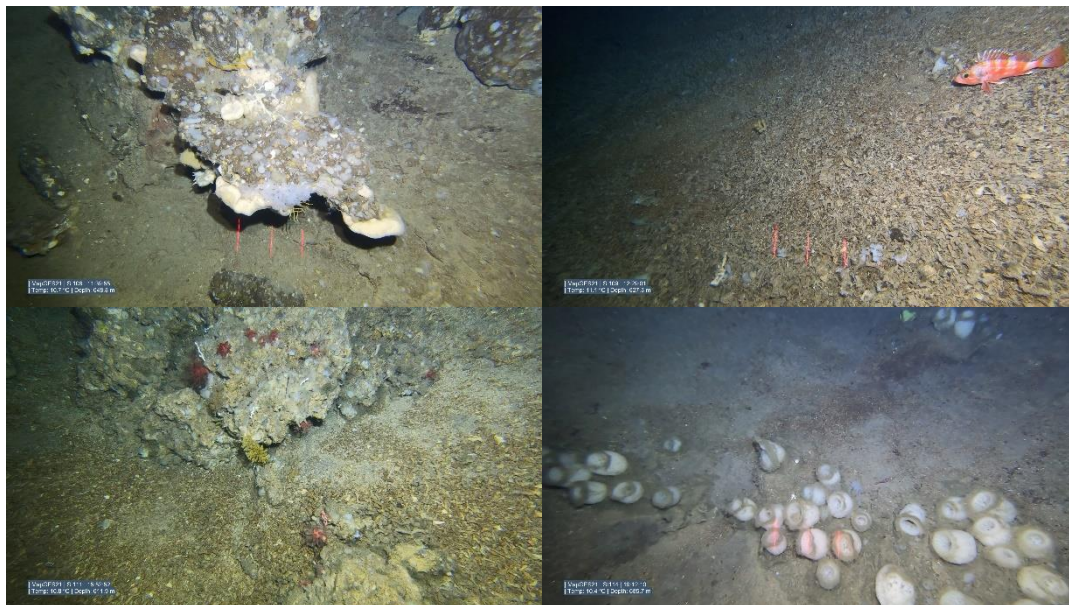


Figure 54. Screenshots taken from the video footage recorded during day 5 of Leg 3 of MapGES 2021 cruise in Baixo São Mateus and the Agulhas 12 milhas bank, south of Faial Island.

4-5 September 2021

The surveys with the Azor drift-cam on board the RV Arquipélago were cancelled because of bad weather conditions.

6 September 2021

We left Horta harbour at around 07:30 to explore Agulhas 12 milhas bank, south of Faial. We started the first dive at around 09:15 and performed 6 dives (St. 115-120) between 520 and 780m depth. The sea conditions were difficult during the day, with a generally strong drift that conditioned especially the first dive. The drift was so strong that we decided to end the dive earlier to avoid the Azor drift-cam getting entangled. Throughout all the dives performed, the seabed was generally characterized by sandy bottoms, usually with scattered basaltic boulders of considerable size. The fauna present in the deepest areas explored included xenophyophores, aggregations of the bird's nest *Pheronema carpenteri* and the hexactinellid *Farrea occa*, as well as occasional observations of the decapod *Aristaeopsis edwardsiana*, several sea urchins belonging to the family Echinothuriidae and small primnoid corals of the species *Narella bellissima*. At shallower depths the fauna observed was more diverse and with higher

abundances, also driven by the greater presence of rocky substrates. The main organisms encountered included large *Characella pachastrelloides*. Some other species observed were the sponges *Macandrewia azorica*, *Stylocordyla pellita* and the soft corals of the genus cf. *Pseudoanthomastus* and cf. *Gersemia*. In the shallower areas, it was common to see the hydrozoan *Lytocarpia myriophyllum* always inhabiting soft sediments. Small shoals of *Hoplostethus mediterraneus* and sporadic *Helicolenus dactylopterus*, *Chlorophthalmus agassizi* and one deep-sea ray of the species *Dipturus intermedius* were also observed. After six successful dives, we started sailing back to land at around 19:30.

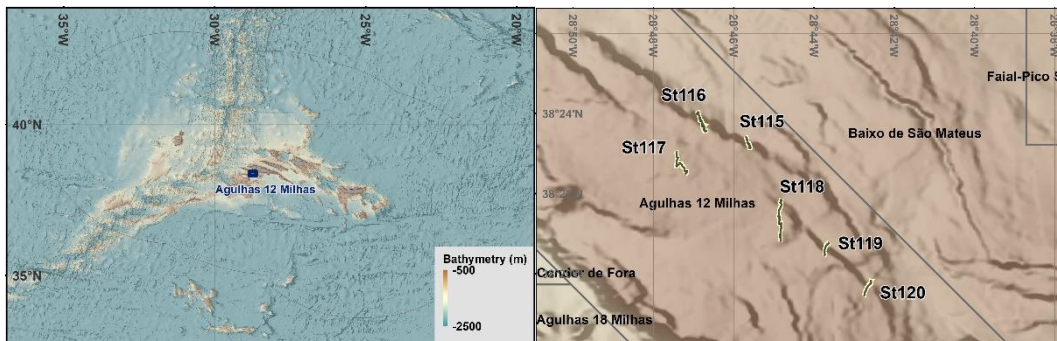


Figure 55. Map showing the dives conducted on day 6 of Leg 3 of MapGES 2021 cruise in Agulhas 12 milhas bank, south of Faial.

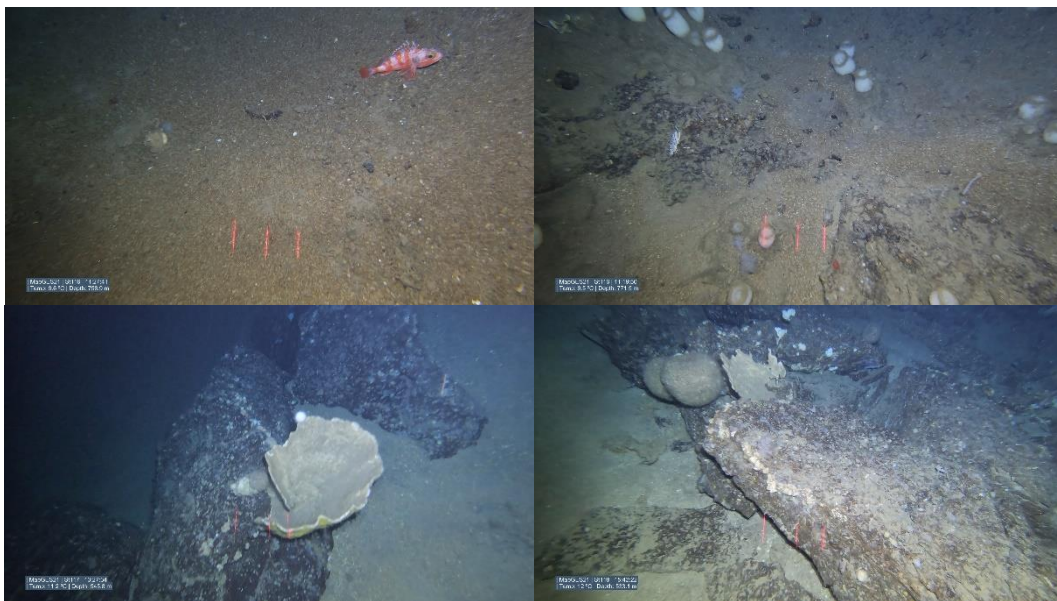


Figure 56. Screenshots taken from the video footage recorded during day 6 of Leg 3 of MapGES 2021 cruise in Agulhas 12 milhas bank, south of Faial.

7 September 2021

We left Horta harbour at around 07:30 to continue the exploration in the Ponta dos Rosais, on the westernmost tip of São Jorge island. We conducted 6 dives (St. 121-126) between 341 and 937m depth. Most dives had some problems related to the direction of the drift, or due to the lack of wind. Some dives were also affected by issues with the live-view image, which made some dives to end early. The seabed was generally characterized by soft sediments, sometimes covered with coral rubble and accompanied by sparse basaltic outcrops. At the deepest areas, the fauna was mainly composed of motile animals, with the decapod *Aristaeopsis edwardsiana*, the

elasmobranchs *Hydrolagus pallidus* and one shark of the genus *Deania*. Sessile fauna at these depths was composed by the sea urchins *Cidaris cidaris* and *Echinus melo*. Shallower areas also showed occurrences of sessile fauna, mainly attached to the sporadic boulders, with *Acanthogorgia* sp. and the whip like *Viminella flagellum*, soft corals, and the sponges *Characella pachastrelloides* and *Desmacella grimaldi*. Motile fauna was more often and predominantly composed of shoals of *Capros aper* and *Hoplostethus mediterraneus*, the ray *Dipturus intermedius* and the orange roughy *Hoplostethus atlanticus*. After six dives, we sailed back to land to arrive in Horta before the beginning of the strike at around 22:00.

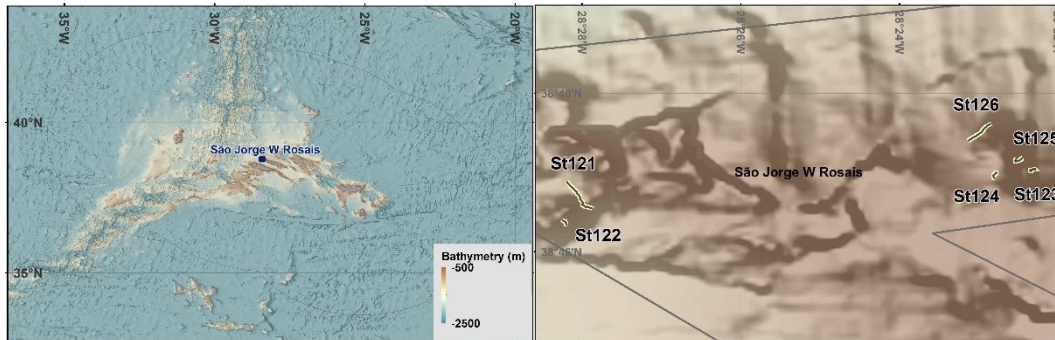


Figure 57. Map showing the dives conducted on day 7 of Leg 3 of MapGES 2021 cruise in the Ponta dos Rosais at the westernmost tip of São Jorge Island.

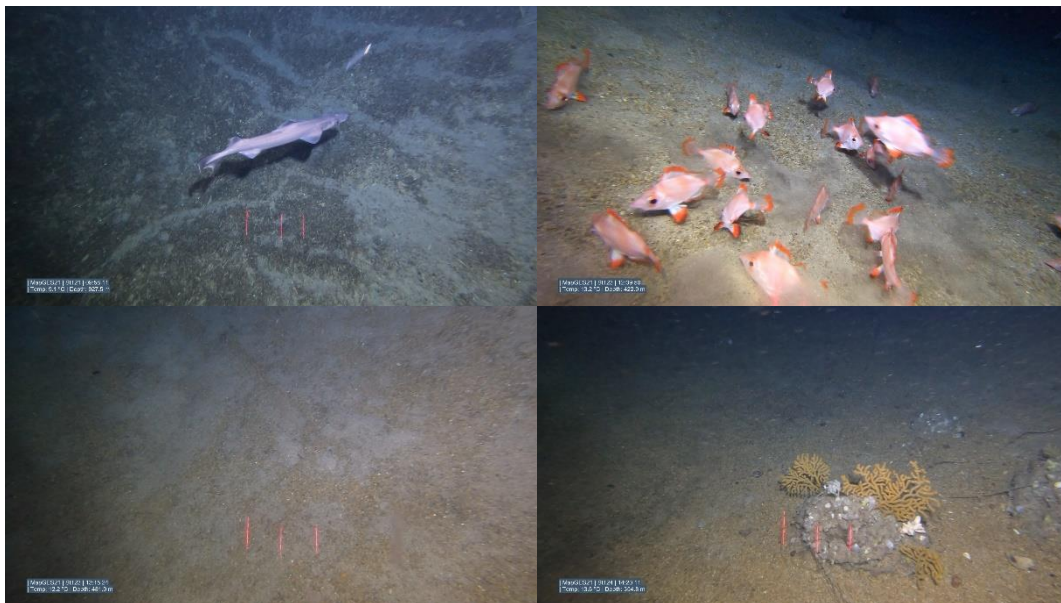


Figure 58. Screenshots taken from the video footage recorded during day 7 of Leg 3 of MapGES 2021 cruise in Ponta dos Rosais at the westernmost tip of São Jorge Island.

8 September 2021

We left Horta harbour at around 07:30 to continue the exploration of Agulhas 12 Milhas bank, south of Faial. We started the first dive at 10:03 and conducted 5 dives (St. 127-131) between 560 and 950 m depth. During the first dive, the lasers were not working due to bad contact, and were replaced before starting the second dive of the day. All areas explored were characterized by sandy bottoms, with some basaltic outcrops (some covered by soft sediment). The sand was mainly colonized by ceriantharians and xenophyophores, with the presence of the ray *Dipturus*

intermedius and a solitary *Dalatias licha*. On the last dive, we observed some small aggregations of *Hyalonema (Cyliconema) thomsonis*. The basaltic outcrops covered in sediments, especially on the deeper areas, were mainly characterized by *Pheronema carpenteri* aggregations and some large sponges such as *Characella pachastrelloides*, *Macandrewia azorica* and *Leiodermatium* sp. On the first dive, there was also a small aggregation of *Stylochordilla pellita*. While moving up to shallower areas, aggregations of both *Narella versluysi* and *N. bellissima* started to appear, sometimes together with *Hemicorallium niobe* and the laminar sponge cf. *Poecillastra compressa*. After a successful day, we started sailing back to land at around 19:00.

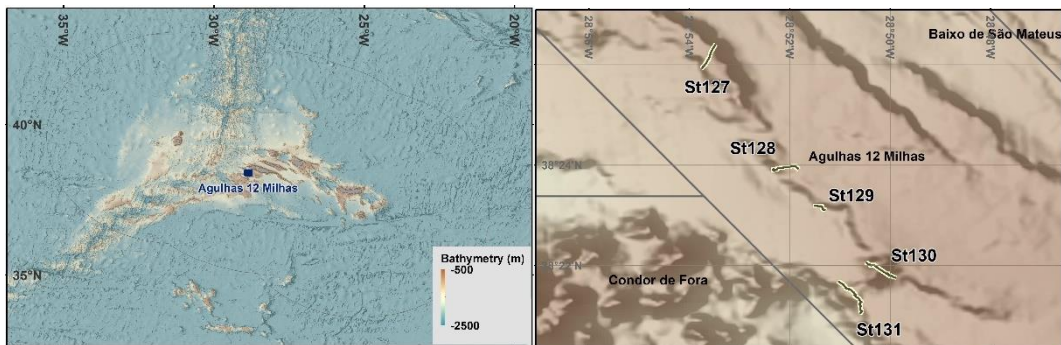


Figure 59. Map showing the dives conducted on day 8 of Leg 3 of MapGES 2021 cruise in Agulhas 12 Milhas, south of Faial Island.



Figure 60. Screenshots taken from the video footage recorded during day 8 of Leg 3 of MapGES 2021 cruise in the Agulhas 12 Milhas, south of Faial Island.

9 September 2021

We continued the exploration of Agulhas 12 Milhas south of Faial. We left harbour at 07:30. In total, 5 dives were conducted (St. 132-136) between 562 and 955m depth, with four successful and one aborted (St. 136). Throughout almost all the dives performed, the drift was good to perform video transects. In all dives, the data logger was not attached to the structure and therefore we do not have temperature and depth data. In general, the substrate observed was mainly composed of hard

basaltic structures, sometimes covered with sand and loose pebbles, as well as outcropping rock that occasionally formed walls. The sessile fauna was mainly observed attached to the hard structures, with some extensive aggregations of the “lollipop” sponge *Stylocordyla pellita* and the frequent glass sponge *Farrea occa*. Some other sponges observed include *Macandrewia azorica*, *Desmacella grimaldi*, *Haliclona filholi*, and big specimens of the genus *Leiodermatium* and *Geodia*. Corals were not as common as sponges, although with sightings of *Callogorgia verticillata*, *Hemicorallium niobe* and some soft corals. Motile fauna was widely observed, including the rare fish *Grammicolepis brachusculus*, a six-gill shark *Hexanchus griseus*, and several others that include shoals of *Hoplostethus mediterraneus*, a *Lophius piscatorius* and *Hoplostethus atlanticus*. The crustaceans *Paromola cuvieri* and *Bathynectes maravigna* were also spotted. We started sailing back to land at around 18:30.

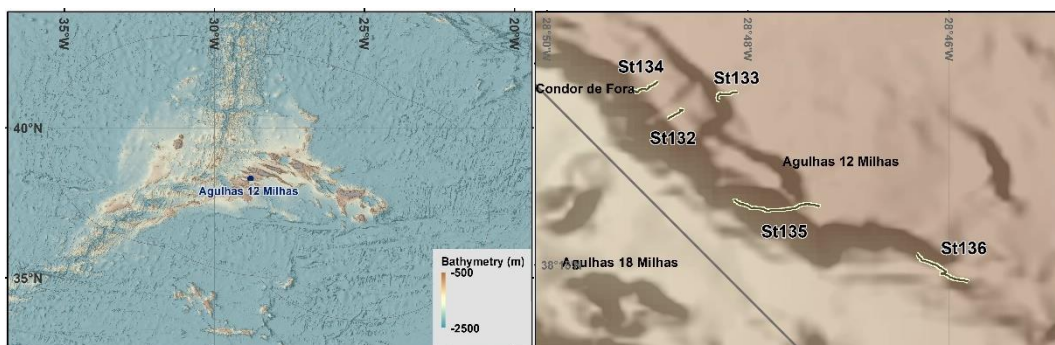


Figure 61. Map showing the dives conducted on day 9 of Leg 3 of MapGES 2021 cruise in the Agulhas 12 Milhas, south of Faial Island.

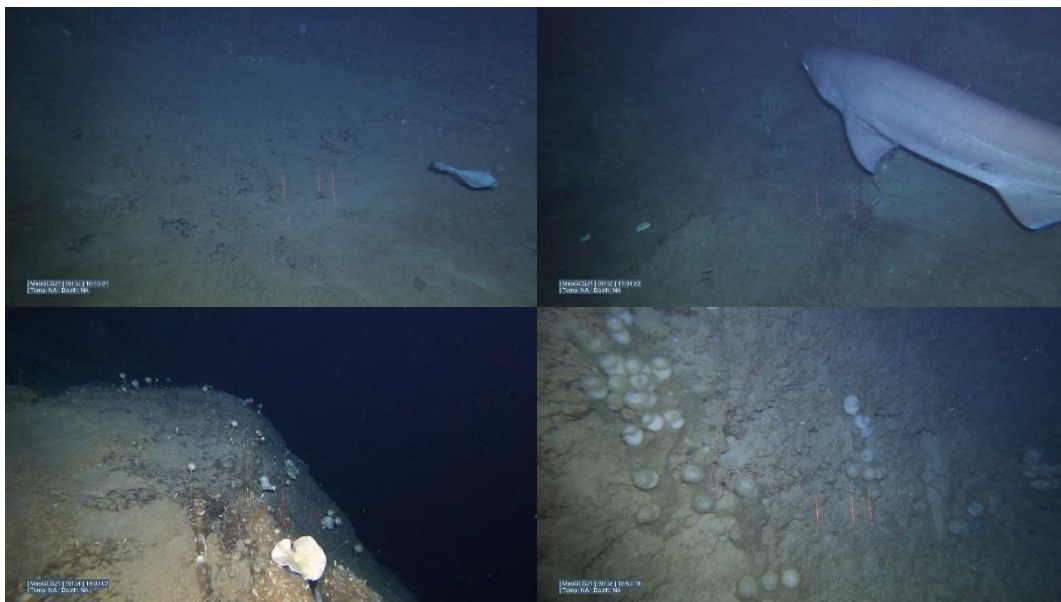


Figure 62. Screenshots taken from the video footage recorded during day 9 of Leg 3 of MapGES 2021 cruise in the Agulhas 12 Milhas, south of Faial Island.

10 September 2021

We left Horta harbor towards the southern part of the Faial-Pico channel. We started the day at around 07:00 in the morning and were able to conduct 5 dives (St. 137-142) between 218 and 744 m depth. During the last dive, we experienced very strong currents, lost the live view feed, and decided to abort the dive (St. 142). We

experienced diverse drift conditions along the day, with no drift in the first dive (St. 137) and strong drift at the end of the day, especially in St. 141. Some water leaked inside the housing of the led lights and one led connection broke. The seabed was generally composed of hard substrates, mainly boulders, sometimes interrupted by sandy patches. Interestingly, in St. 139 the seabed was highly formed by lava pillows. The fauna observed in the deepest areas included a limited number of species, including the decapod *Bathynectes maravigna*, sparse sea urchins of the family Echinoturiidae and sponges of the species *Hyalonema (Cyliconema) thomsonis*, as well as some fishes belonging to the family Macrouridae and the species *Galeus murinus*. At decreasing depths, biodiversity increased together with the abundance of fauna. On the basaltic boulders, it was common to observe corals such as *Viminella flagellum* and *Callogorgia verticillata*, and a few black corals of the species *Elatopathes abietina*. Sponges were the main group, with the common sighting of large *Characella pachastrelloides*, *Haliclona implexa*, several *Macandrewia azorica*, *Pseudotrachia hystrix*, and from the genus *Leiodermatium* and *Petrosia*. Motile fauna at the shallower parts included shoals of *Capros aper* and *Anthias anthias*, and the common, although less abundant, bluemouth rockfish *Helicolenus dactylopterus*. The weather conditions got difficult towards the end of the afternoon, and we decided to go back to land at around 16:00.

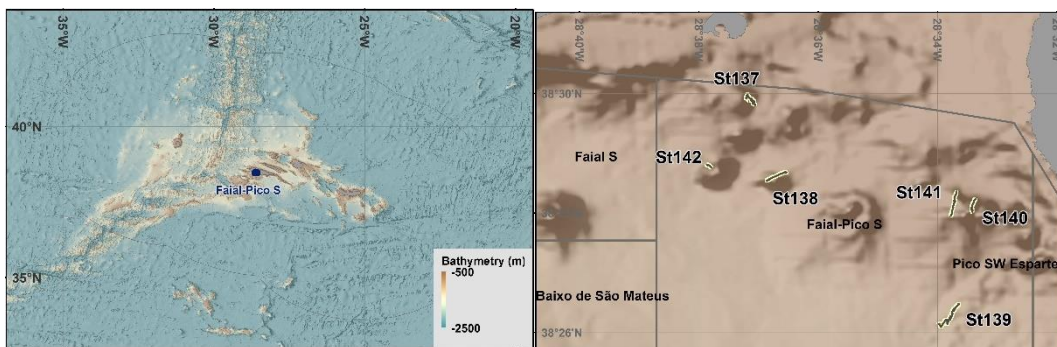


Figure 63. Map showing the dives conducted on day 10 of Leg 3 of MapGES 2021 cruise in the southern end of the Faial-Pico channel.

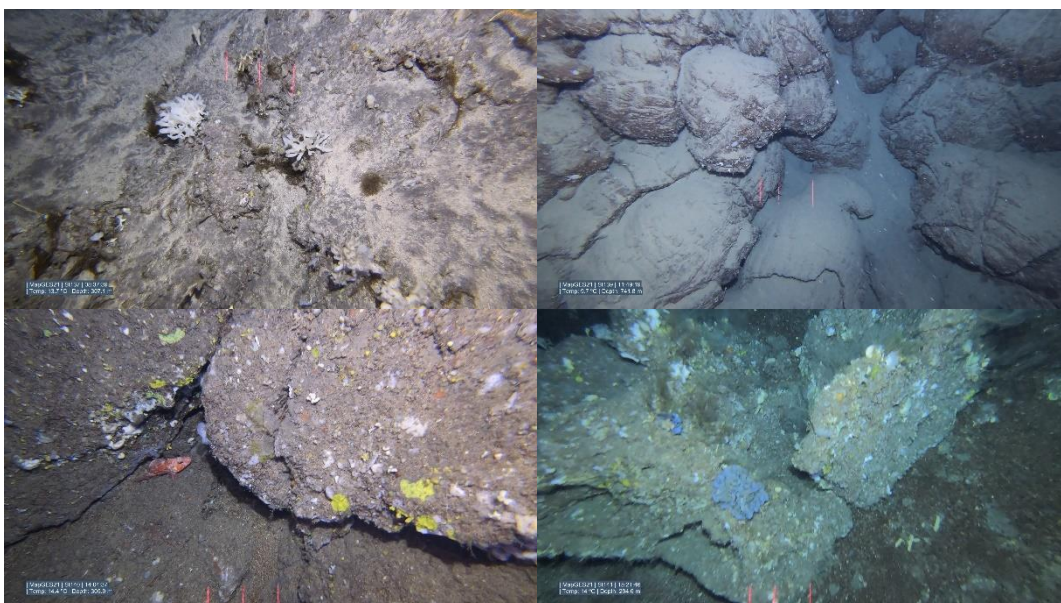


Figure 64. Screenshots taken from the video footage recorded during day 10 of Leg 3 of MapGES 2021 cruise in the southern end of the Faial-Pico channel.

11-13 September 2021

The surveys with the Azor drift-cam on board the RV Arquipélago were cancelled because of bad weather conditions.

14 September 2021

We left Horta harbor at around 07:30 to explore the NW slopes of Pico island. During this day, we completed seven dives (St. 143-149) between depths of 227 and 766 m. In general, all dives had very little fauna, with sponges being the most diverse group in all explored areas. The deepest areas were mainly characterized by slopes and rocky bottoms covered with soft sediments and occasional basaltic boulders and outcrops, covered with small and encrusting sponges. In these areas, we observed several sea urchins of the family Echinoturiidae, hermit crabs and the foraminifera *Syringamina fragillissima*. Common to both areas were the sea urchin *Echinus melo*, the commercial fishes *Helicolenus dactylopterus*, *Hoplostethus mediterraneus*, and the sponges *Characella pachastrelloides* and *Macandrewia azorica*. The shallower areas were also characterized by soft bottoms and the sponges found were *Haliclona implexa*, *Phakellia ventilabrum*, *Pseudotrachya hystrix* and *Neophrissospongia nolitangere*. This was also the area with more corals, including *Viminella flagellum* and small colonies of *Acanthogorgia* sp. After seven successful dives, we started sailing back to land at around 20:00.

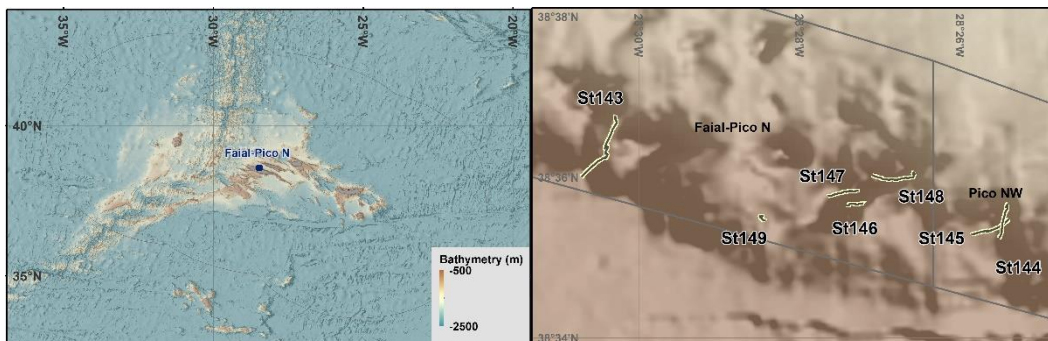


Figure 65. Map showing the dives conducted on the day 11 of Leg 3 of MapGES 2021 cruise in the slopes of northern Pico Island, close to Lajes.

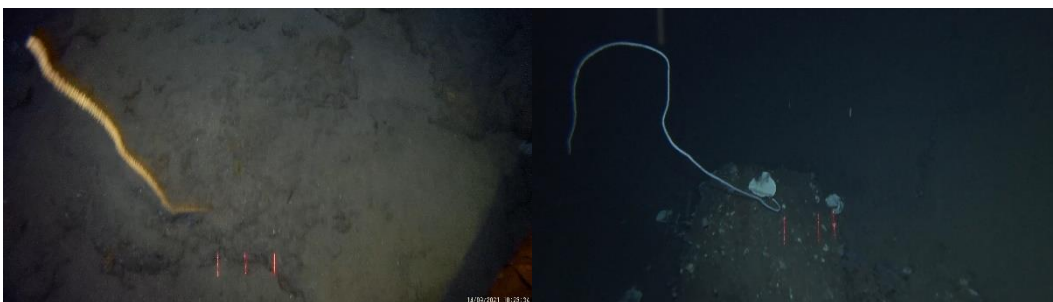


Figure 66. Screenshots taken from the video footage recorded during day 11 of Leg 3 of MapGES 2021 cruise in slopes of northern Pico Island.

15 September 2021

We left Horta harbor at around 07:30 to continue the exploration of the northwestern slopes of Pico Island. We performed a total of 6 dives (St. 150-155), between 129 and 714 m depth. The drift did not always go as planned, with several

dives with some technical issues, such as the positioning of the lasers and the Gopro camera. In St. 154 the Azor drift-cam got stuck on a rock in a very irregular bottom but was released after 10 minutes. The deepest areas explored were mainly covered in soft sediments, with occasional boulders colonized by encrusting sponges and sandy bottoms hosted xenophyophores. The most common mobile fauna were fishes of the Macrouridae family and sea urchins of the species *Echinus melo*. As we navigated to shallower areas, the sessile fauna became more abundant with sponges as the dominant species colonizing the available substrate, including *Macandrewia azorica*, *Haliclona implexa*, *Phakellia ventilabrum* and *Pseudotrachya hystrix*. Occasionally, it was possible to observe solitary and small colonies of *Callogorgia verticillata*, *Viminella flagellum*, small aggregations of the lace corals *Errina dabneyi* and the black coral *Antipathella subpinnata*. In the shallower areas, the motile fauna was also more diverse, and we were able to spot several commercial fishes like *Helicolenus dactylopterus*, *Conger conger*, *Pontinus kuhlii*, some sharks and sea urchins *Echinus melo*. After six successful dives, we started sailing back to land at around 20:00.

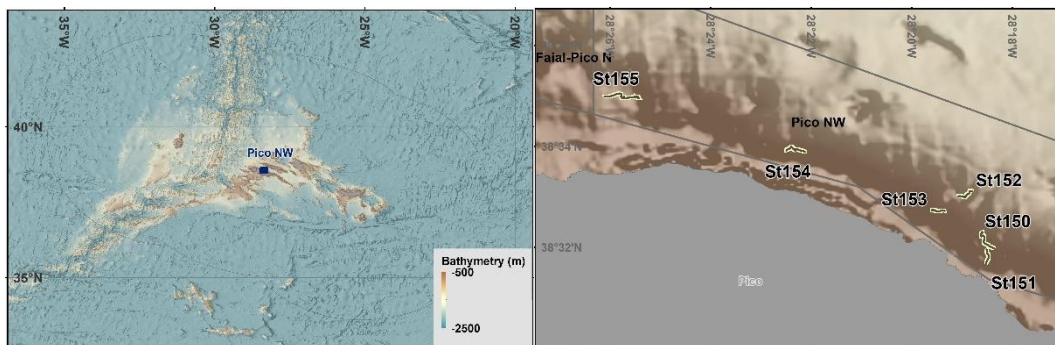


Figure 67. Map showing the dives conducted on day 12 of Leg 3 of MapGES 2021 cruise in the northwestern slopes of Pico Island.

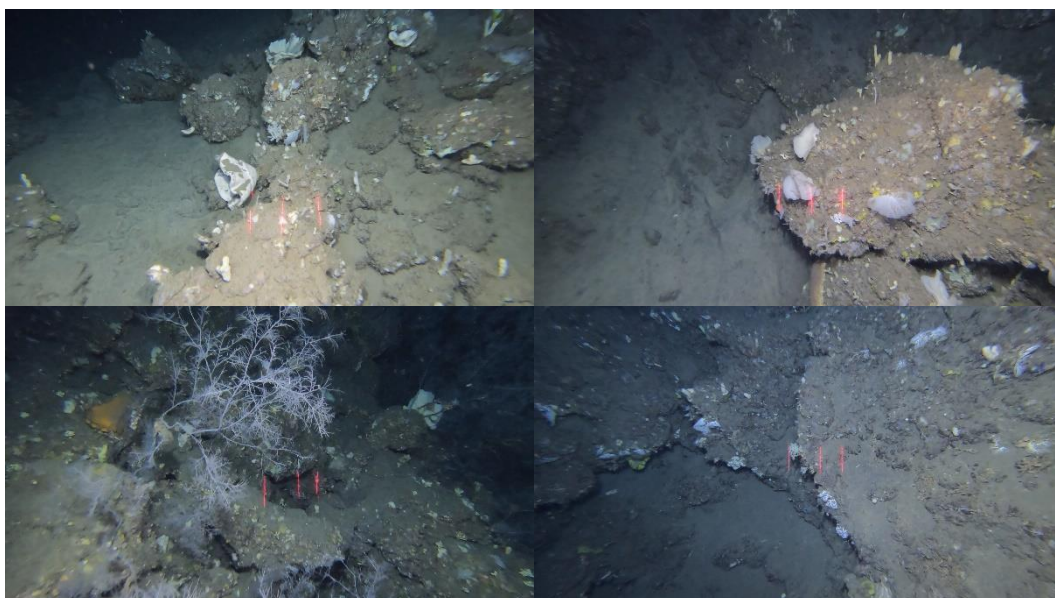


Figure 68. Screenshots taken from the video footage recorded during day 12 of Leg 3 of MapGES 2021 cruise in the northwestern slopes of Pico Island.

“Life” on board RV Arquipelágo during MapGES 2021



