

MapGES 2022 Cruise Report: Exploration and mapping of deep-sea biodiversity in the Azores, summer 2022

MapGES & iAtlantic Project

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Summary report

Main objective: MapGES 2022 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 from the RV Arquipélago and were lucky to finally explore some long-awaited areas such as the Diogo de Teive and Cachalote seamounts, the Flores island slopes (western Azores), but also the Girard, Maria Celeste, Formigas and Margrette seamounts and the island slopes of Santa Maria (eastern Azores). As in other MapGES cruises, the objectives were to (i) map 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 distribution patterns of deep-sea benthic biodiversity in the Azores region. The results of this cruise, when added to the previous contributions, will help 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), which 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.

Scientific team in Leg 1: Telmo Morato (chief scientist), Sérgio Gomes, Luís Rodrigues, Guilherme Gonçalves, Inês Carneiro

Scientific team in Leg 2: Telmo Morato and Carlos Dominguez-Carrió (chief scientists), Sérgio Gomes, Luís Rodrigues, Guilherme Gonçalves, Manuela Ramos

Cruise summary: The MapGES 2022 survey was divided in 2 legs, which were planned to explore very distant areas of the Azores, namely the eastern and western group of islands (Table 1, Figure 1). Overall, ~130 dives were accomplished in 22 sampling areas, which include 11 seamounts and the slopes of 5 different islands (Table 2). During **Leg 1**, from 6th to 23rd July 2022, we performed 62 dives with the Azor drift-cam, covering 36.3 km of the seafloor and producing 60:33 hours of video footage, 3.31TB of disc space. This leg surveyed the deep-sea benthic communities dwelling on the slopes of Flores island and Diogo de Teive and Cachalote seamounts on board of the research vessel Arquipélago, together with some dives around Faial, Pico and São Jorge islands. During, **Leg 2**, from 14th to 28th August 2022, we performed 72 dives with the Azor drift-cam, covering 35 km of the seafloor and producing 69:38 hours of video footage, 3.82TB of disc space. This leg surveyed the slopes around Santa Maria island, as well as several seamounts on their vicinity, some located on the easternmost part of the Azores archipelago. Leg 2 explored for the first time the seamounts of Albatroz do Meio, Girard, Maria Celeste and Margrette seamounts, and collected new information on the shallower areas of Formigas seamount, for which data was still lacking to complete the exploratory dives done in previous surveys.

Main achievements:

1. During the MapGES 2022 cruise we accomplished of more than 130 underwater video transects between 190 and 1099 m depth with the Azor drift-cam, adding up to around 130 new hours of underwater video footage of seabed habitats. 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 with only minor damages. These collateral fishing impacts, i.e., preventing the acquisition of deep-sea biodiversity data to inform management deserve to be better quantified.
2. Deep-sea exploration with the Azor drift-cam confirmed that **Diogo de Teive seamount may classify as a near-natural or pristine area**. The Portuguese Hydrographic Institute mapped this seamount in 2019 and found that it was much shallower than previous maps indicated. Because of the lack of known fishing events, we classified Diogo de Teive as a potential near-natural or pristine area. During the dives performed in Leg 1, we found many large and intact colonies of the coral *Callogorgia verticillata* that showed no signs of impacts from fishing activity, and we also encountered large schools of the wreckfish *Polyprion americanus*. More exploration may be needed, but this area should be kept in the list of priority areas for conservation in the Azores.
3. We **explored the Cachalote seamount with the Azor drift-cam**, after almost 4 years of waiting. The Portuguese Hydrographic Institute also mapped this seamount back in 2018 and revealed its flat-topped structure. The benthic communities showed a clear vertical stratification, with extensive gardens of *Narella bellissima* and *Narella versluysi* at depths between 700 m and 900 m, with areas characterized by the bamboo coral *Acanella arbuscula*. At 500-600 m depth, coral gardens of *Callogorgia verticillata* and *Viminella flagellum* were observed, together with many other species of corals and sponges. We also drifted over some alfonsinos, silver roughy, wreckfish, and saw lost fishing lines, both on the deeper dives and also on the summit. Although there were quite a

few large *Callogorgia verticillata* colonies, many of them showed signs of fishing impacts, such as broken or missing branches.

4. We also explored the deep sea around Flores island, the westernmost point of the Azores and Europe, but sitting on the North American Plate. We were stunned by two **very dense patches of large pink and white bubblegum corals** (*Paragorgia cf. johnsoni*) that resemble those observed in the Gigante Western Ridge. These areas are good candidates for breaking the record of the densest bubblegum coral garden in the Azores. The coral gardens seemed to be in reasonably good conditions, despite the fact that many colonies showed signs of impacts, some even found lying broken over the seafloor. We were also stunned by the diverse fauna colonizing the steep walls that can be found around Flores island, where large corals resembling *Paramuricea* were filmed, as well as by the diverse benthic communities observed with several species of corals and sponges, including *Acanthogorgia* sp., *Dentomuricea cf. meteor*, white and yellow *Viminella flagellum*, *Elatopathes abietina* and *Leiodermatium* sp.
5. Deep-sea exploration with the Azor drift-cam of several isolated seamounts located between the islands of Pico and Santa Maria (Albatroz do Meio, Girard, Maria Celeste) for which no information regarding their benthic communities was previously available. The images recorded revealed a diverse benthic ecosystem characterized by (among several other assemblages) **dense coral gardens of *Narella versluysi*, *Narella bellissima* and *Candidella imbricata*, aggregations of Stylasterids, large *Callogorgia verticillata* colonies and sponge grounds** with the barrel sponge *Pheronema carpenteri*, as well as extensive areas with deposits of coral rubble.
6. We completed **the first visual survey to the slopes of Santa Maria island**, with a total of 30 dives carried out with the Azor drift-cam at depths between 200 and 1070 m depth, covering the whole perimeter of the island. The habitats explored host rich benthic communities, with black corals of the genus *Leiopathes* on its deepest areas, coral gardens of *Narella versluysi* and *Narella bellissima* and sponge grounds with *Pheronema carpenteri* at intermediate depths, and coral gardens with *Viminella flagellum* and *Callogorgia verticillata*, as well as aggregations of giant sponges of the genus *Characella*, in the shallowest areas explored, among several other assemblages.
7. We explored areas below 600 m depth inside the Marine Protected Area (MPA) of Formigas seamount to complete the exploratory work performed in deeper areas during the MedWaves cruise in 2016. **The dives unveiled one of the largest and densest aggregations of the primnoid coral *Callogorgia verticillata* ever recorded in the Azores**, which was found on the northern slopes of Formigas seamount. Although the area has been protected for several years, we were surprised by the amount of lost or abandoned fishing lines observed laying over the seabed.
8. We performed the first dives ever on Margrette seamount, the easternmost part of the Azores archipelago shallower than 1000 m depth, and hence that can be surveyed with the Azor drift-cam. Margrette seamount appeared to be a very complex area in terms of its geological morphology, with **several vertical walls that complicated the exploratory work** performed.
9. Discovered dense and diverse coral gardens and sponge grounds whose presence was unknown to science and that may fit the FAO criteria to be considered Vulnerable Marine Ecosystems (VMEs).

Table 1. Areas surveyed during each of the legs of MapGES_2022 cruise, with information on the amount of underwater terrain explored and time of filming accomplished.

Leg	Dates	Areas explored	Dives	km	Bottom time (h)
1	06-23 July	Canal Faial-Pico, slopes west of São Jorge island, Diogo de Teive, slopes of Flores island, Cachalote	62	36	60.5
2	14-28 August	Albatroz do Meio, Girard, Maria Celeste, slopes of Santa Maria island, Formigas, Margrette	72	35	69.5
Total			134	71	130

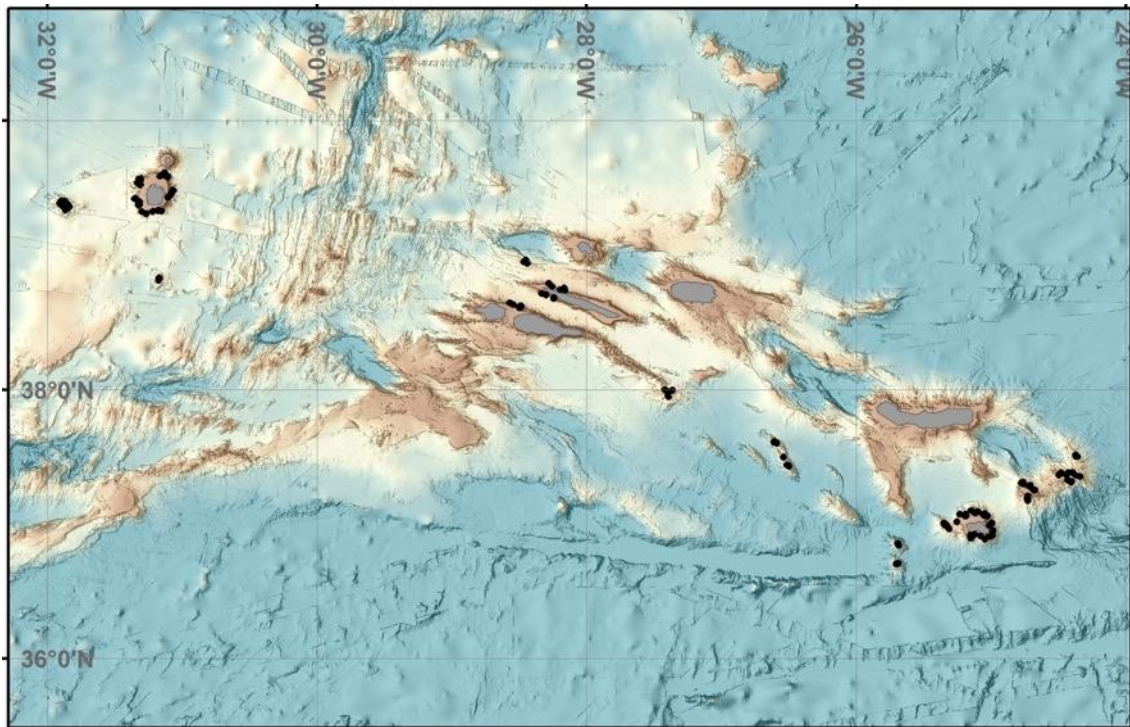


Figure 1. Location of the ~130 dives performed with the Azor drift-cam in seamounts and island slopes around the eastern and western groups during the 2 legs of the MapGES 2022 survey.

Table 2. Compilation of the stations surveyed during MapGES_2022 cruise.

St	Location	Date	Time		Start position		End position		Depth (m)	Dist. start - end (m)
			Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)		
1	Canal Faial-Pico	06/07/22	9:11	10:21	38° 36.366'	28° 30.022'	38° 36.418'	28° 30.126'	431-414	170
2	Canal Faial-Pico	06/07/22	10:39	11:52	38° 36.582'	28° 29.343'	38° 36.505'	28° 29.66'	578-412	480
3	Canal Faial-Pico	06/07/22	12:09	13:48	38° 37.349'	28° 29.110'	38° 37.385'	28° 29.829'	823-875	1040
4	Canal Faial-Pico	06/07/22	14:11	15:45	38° 38.037'	28° 32.685'	38° 38.122'	28° 33.26'	795-681	840
5	Canal Faial-Pico	06/07/22	16:03	17:24	38° 38.842'	28° 34.046'	38° 38.771'	28° 34.372'	762-657	480
6	Picos dos Rosais	07/07/22	10:40	12:12	38° 57.217'	28° 27.765'	38° 57.089'	28° 28.115'	697-623	550
7	Picos dos Rosais	07/07/22	12:49	14:06	38° 56.941'	28° 28.028'	38° 56.998'	28° 28.142'	691-614	190
8	Picos dos Rosais	07/07/22	14:20	15:42	38° 57.922'	28° 27.115'	38° 57.952'	28° 27.367'	662-552	360
9	Picos dos Rosais	07/07/22	16:04	17:31	38° 56.158'	28° 26.53'	38° 56.155'	28° 26.587'	753-810	80
10	SW São Jorge	08/07/22	9:35	10:57	38° 42.421'	28° 18.335'	38° 42.197'	28° 18.100'	785-517	530
11	SW São Jorge	08/07/22	11:24	12:44	38° 41.099'	28° 14.77'	38° 40.662'	28° 14.052'	444-530	1310
12	SW São Jorge	08/07/22	13:06	14:08	38° 41.217'	28° 14.371'	38° 40.943'	28° 14.689'	180-413	680
13	SW São Jorge	08/07/22	14:51	16:09	38° 43.213'	28° 20.113'	38° 42.908'	28° 20.232'	840-923	590
14	SW São Jorge	08/07/22	16:26	17:44	38° 43.042'	28° 19.717'	38° 42.692'	28° 19.779'	797-992	650
15	NW São Jorge	11/07/22	10:03	11:09	38° 47.430'	28° 16.914'	38° 47.393'	28° 16.566'	689-644	500
16	NW São Jorge	11/07/22	11:25	12:58	38° 46.212'	28° 15.647'	38° 45.999'	28° 15.249'	579-480	690
17	NW São Jorge	11/07/22	13:22	14:13	38° 44.59'	28° 11.853'	38° 44.516'	28° 11.841'	381-381	475
18	NW São Jorge	11/07/22	14:49	16:06	38° 44.363'	28° 9.857'	38° 44.274'	28° 9.757'	586-540	210
19	NW São Jorge	11/07/22	16:25	17:51	38° 45.499'	28° 10.089'	38° 45.397'	28° 9.972'	872-895	250
20	Diogo Teive	15/07/22	15:01	16:26	38° 49.971'	31° 10.566'	38° 49.674'	31° 10.002'	676-828	980
21	Diogo Teive	15/07/22	16:51	18:19	38° 49.916'	31° 10.641'	38° 49.64'	31° 10.281'	702-668	720
22	Diogo Teive	15/07/22	18:38	19:58	38° 48.793'	31° 10.665'	38° 48.573'	31° 10.733'	863-863	410
23	Flores NW	16/07/22	8:38	9:38	39° 34.100'	31° 19.322'	39° 34.032'	31° 19.566'	628-569	370
24	Flores NW	16/07/22	10:01	11:21	39° 34.091'	31° 18.444'	39° 34.274'	31° 18.561'	584-708	370
25	Flores NW	16/07/22	11:34	13:37	39° 33.456'	31° 19.069'	39° 33.523'	31° 18.369'	650-488	1000
26	Flores NW	16/07/22	14:02	15:38	39° 32.234'	31° 20.204'	39° 32.474'	31° 19.813'	984-927	710
27	Flores NW	16/07/22	15:55	17:45	39° 31.282'	31° 19.125'	39° 31.401'	31° 18.434'	503-387	1010
28	Flores NW	17/07/22	8:19	9:10	39° 25.492'	31° 21.003'	39° 25.483'	31° 20.902'	536-581	140
29	Flores NW	17/07/22	9:22	10:39	39° 25.251'	31° 21.467'	39° 25.168'	31° 21.286'	489-530	300
30	Flores NW	17/07/22	10:57	12:35	39° 23.786'	31° 19.825'	39° 23.859'	31° 19.565'	726-634	390
31	Flores NW	17/07/22	12:44	14:29	39° 23.915'	31° 19.406'	39° 23.892'	31° 19.038'	572-383	520
32	Flores NW	17/07/22	15:10	16:41	39° 22.454'	31° 19.844'	39° 22.162'	31° 19.625'	937-933	620
33	Flores NW	17/07/22	16:55	18:09	39° 22.614'	31° 19.313'	39° 22.553'	31° 18.999'	651-465	460
34	Cachalote	18/07/22	7:57	9:39	39° 24.221'	31° 54.165'	39° 23.935'	31° 53.908'	775-762	640
35	Cachalote	18/07/22	9:53	12:07	39° 23.832'	31° 54.485'	39° 23.496'	31° 54.053'	760-537	870
36	Cachalote	18/07/22	12:25	14:04	39° 24.214'	31° 52.535'	39° 24.097'	31° 52.165'	897-794	570
37	Cachalote	18/07/22	14:27	15:53	39° 23.092'	31° 54.719'	39° 22.730'	31° 54.569'	551-555	700
38	Cachalote	18/07/22	16:11	17:40	39° 22.444'	31° 53.644'	39° 21.931'	31° 53.477'	496-514	980
39	Cachalote	18/07/22	17:58	20:23	39° 20.548'	31° 52.270'	39° 19.889'	31° 52.299'	916-878	1220
40	Cachalote	19/07/22	7:52	8:58	39° 22.837'	31° 51.15'	39° 22.545'	31° 50.933'	819-762	620
41	Cachalote	19/07/22	9:26	11:37	39° 23.571'	31° 53.115'	39° 22.737'	31° 52.651'	550-471	1680
42	Cachalote	19/07/22	11:48	13:22	39° 22.521'	31° 53.083'	39° 21.955'	31° 52.987'	481-503	1050
43	Cachalote	19/07/22	13:40	15:08	39° 21.101'	31° 51.321'	39° 20.722'	31° 51.305'	757-738	700
44	Cachalote	19/07/22	15:32	16:55	39° 21.902'	31° 50.447'	39° 21.559'	31° 50.38'	863-681	640
45	Flores S	20/07/22	8:36	10:03	39° 19.447'	31° 9.471'	39° 19.638'	31° 9.252'	835-677	470
46	Flores S	20/07/22	10:25	12:15	39° 19.862'	31° 10.934'	39° 20.28'	31° 10.994'	820-583	770
47	Flores S	20/07/22	12:34	13:51	39° 19.363'	31° 13.308'	39° 19.623'	31° 13.362'	605-493	480
48	Flores S	20/07/22	14:02	15:22	39° 19.570'	31° 13.26'	39° 19.656'	31° 13.001'	516-660	400
49	Flores S	20/07/22	15:51	17:28	39° 18.63'	31° 16.461'	39° 18.511'	31° 16.148'	613-547	500
50	Flores S	20/07/22	17:50	19:03	39° 19.502'	31° 18.189'	39° 19.288'	31° 17.813'	445-378	660
51	Flores NE	21/07/22	8:08	9:42	39° 34.822'	31° 06.76'	39° 34.838'	31° 06.706'	476-468	80
52	Flores NE	21/07/22	9:49	11:28	39° 35.322'	31° 06.63'	39° 35.235'	31° 06.764'	770-665	250
53	Flores NE	21/07/22	11:46	13:16	39° 35.660'	31° 08.319'	39° 35.819'	31° 08.600'	829-608	490
54	Flores NE	21/07/22	13:37	14:40	39° 35.761'	31° 09.407'	39° 35.922'	31° 09.308'	651-655	330
55	Flores NE	21/07/22	14:56	15:41	39° 35.179'	31° 10.134'	39° 35.293'	31° 09.925'	333-425	360
56	Flores NE	21/07/22	15:59	17:35	39° 36.779'	31° 08.05'	39° 36.930'	31° 07.826'	784-843	420
57	Flores E	22/07/22	8:14	9:29	39° 28.75'	31° 04.27'	39° 28.696'	31° 04.142'	794-755	200
58	Flores E	22/07/22	9:39	10:36	39° 29.062'	31° 04.194'	39° 28.941'	31° 04.031'	615-622	320
59	Flores E	22/07/22	10:49	12:00	39° 27.959'	31° 05.012'	39° 27.697'	31° 04.061'	477-646	1440
60	Flores E	22/07/22	12:12	13:08	39° 26.814'	31° 05.417'	39° 26.728'	31° 05.313'	727-791	210
61	Flores E	22/07/22	13:18	14:51	39° 26.949'	31° 05.152'	39° 26.916'	31° 05.472'	754-646	460
62	Flores E	22/07/22	15:08	16:11	39° 25.597'	31° 06.405'	39° 25.964'	31° 06.453'	345-198	680

St	Location	Date	Time		Start position		End position		Depth (m)	Dist.
			Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)		
63	Albatroz do meio	15/08/22	8:11	10:11	38° 0.073'	27° 25.362'	37° 59.907'	27° 25.557'	808-615	410
64	Albatroz do meio	15/08/22	10:27	11:14	37° 59.92'	27° 25.158'	37° 59.871'	27° 24.894'	610-581	390
65	Albatroz do meio	15/08/22	11:23	12:18	37° 59.773'	27° 25.124'	37° 59.748'	27° 24.914'	515-640	310
66	Albatroz do meio	15/08/22	12:28	14:01	37° 59.223'	27° 24.453'	37° 59.183'	27° 24.18'	699-666	400
67	Albatroz do meio	15/08/22	14:19	15:38	37° 59.542'	27° 22.232'	37° 59.472'	27° 22.100'	873-869	230
68	Albatroz do meio	15/08/22	15:58	17:13	37° 59.843'	27° 21.919'	37° 59.84'	27° 22.023'	558-638	150
69	Albatroz do meio	15/08/22	17:40	19:15	37° 56.958'	27° 23.768'	37° 57.165'	27° 23.911'	917-885	430
70	Girard	16/08/22	08:18	9:31	37° 36.529'	26° 36.515'	37° 36.470'	26° 36.729'	875-1080	330
71	Girard	16/08/22	9:50	10:07	37° 36.956'	26° 36.495'	37° 36.689'	26° 36.737'	897-750	600
72	Girard	16/08/22	11:26	13:23	37° 36.86'	26° 35.453'	37° 35.973'	26° 35.479'	887-745	1640
73	Girard	16/08/22	14:24	15:25	37° 29.948'	26° 32.513'	37° 30.161'	26° 32.427'	988-1074	410
74	Girard	16/08/22	16:05	17:42	37° 26.433'	26° 30.814'	37° 26.295'	26° 30.347'	960-873	730
75	Girard	16/08/22	17:54	18:57	37° 25.847'	26° 30.223'	37° 25.791'	26° 29.967'	817-909	390
76	Maria Celeste	17/08/22	8:14	10:35	36° 42.51'	25° 41.370'	36° 42.220'	25° 42.833'	888-770	2230
77	Maria Celeste	17/08/22	10:47	12:00	36° 42.399'	25° 41.954'	36° 42.210'	25° 41.954'	703-657	350
78	Maria Celeste	17/08/22	12:14	13:43	36° 42.444'	25° 42.179'	36° 42.309'	25° 42.281'	652-626	290
79	Maria Celeste	17/08/22	15:12	16:04	36° 50.475'	25° 41.124'	36° 50.473'	25° 41.153'	754-752	40
80	Maria Celeste	17/08/22	16:41	18:38	36° 51.52'	25° 41.527'	36° 50.997'	25° 41.445'	943-875	970
81	Pico W Sta Maria	18/08/22	7:58	9:39	36° 59.126'	25° 19.443'	36° 58.892'	25° 19.788'	634-522	670
82	Pico W Sta Maria	18/08/22	9:56	12:23	37° 00.028'	25° 20.162'	36° 59.631'	25° 20.824'	915-752	1220
83	Pico W Sta Maria	18/08/22	12:39	14:33	37° 00.508'	25° 21.374'	37° 00.454'	25° 21.366'	965-869	100
84	Pico W Sta Maria	18/08/22	15:34	16:56	36° 58.052'	25° 18.850'	36° 57.929'	25° 18.689'	623-901	320
85	Pico W Sta Maria	18/08/22	17:10	18:38	36° 58.524'	25° 19.117'	36° 58.490'	25° 19.118'	540-502	60
86	Sta Maria NW	19/08/22	7:54	10:08	37° 04.623'	25° 11.341'	37° 4.459'	25° 11.450'	806-720	340
87	Sta Maria NW	19/08/22	10:19	12:13	37° 04.384'	25° 11.454'	37° 3.997'	25° 11.640'	612-484	760
88	Sta Maria NW	19/08/22	12:26	14:10	37° 03.774'	25° 11.142'	37° 3.435'	25° 11.664'	431-180	990
89	Sta Maria NW	19/08/22	14:31	16:17	37° 04.582'	25° 13.922'	37° 4.518'	25° 14.150'	895-945	350
90	Sta Maria NW	19/08/22	16:46	18:09	37° 01.148'	25° 15.127'	37° 01.100'	25° 15.171'	635-540	110
91	Sta Maria NW	19/08/22	18:12	19:02	37° 01.011'	25° 15.217'	37° 01.057'	25° 15.202'	577-568	80
92	Sta Maria E	20/08/22	7:56	9:50	36° 59.381'	25° 00.467'	36° 59.459'	25° 1.085'	662-307	920
93	Sta Maria E	20/08/22	10:07	11:44	37° 0.533'	24° 59.602'	37° 0.418'	24° 59.915'	950-720	500
94	Sta Maria E	20/08/22	12:10	13:59	36° 57.087'	24° 59.029'	36° 56.494'	24° 58.57'	660-288	1290
95	Sta Maria E	20/08/22	14:16	15:39	36° 55.083'	24° 59.455'	36° 54.687'	24° 59.911'	625-460	990
96	Sta Maria E	20/08/22	15:52	16:35	36° 54.457'	25° 01.198'	36° 54.294'	25° 01.469'	263-200	500
97	Formigas	22/08/22	8:08		37° 15.240'	24° 40.439'	37° 15.047'	24° 40.824'	740-554	670
98	Formigas	22/08/22	10:25	11:08	37° 15.794'	24° 41.567'			431	
99	Formigas	22/08/22	11:38	13:38	37° 17.502'	24° 42.643'	37° 17.004'	24° 43.107'	675-590	1140
100	Formigas	22/08/22	14:02		37° 18.804'	24° 45.856'	37° 18.813'	24° 46.547'	560-516	1010
101	Formigas	22/08/22	14:47	16:09	37° 17.916'	24° 45.798'			278	
102	Formigas	22/08/22	16:23	17:13					337	
103	Formigas	22/08/22	17:34	19:23	37° 17.884'	24° 45.411'	37° 18.021'	24° 45.861'	442-276	710
104	Formigas NE	23/08/22	7:43	9:55	37° 30.980'	24° 22.349'	37° 30.789'	24° 22.568'	880-799	470
105	Formigas NE	23/08/22	10:09	12:20	37° 30.108'	24° 21.601'	37° 30.205'	24° 22.207'	786-728	900
106	Margrette E	23/08/22	13:59	14:16	37° 21.176'	24° 20.505'			648-637	
107	Margrette E	23/08/22	14:56	16:02	37° 21.207'	24° 20.507'	37° 21.309'	24° 20.447'	642-635	200
108	Margrette E	23/08/22	16:42		37° 21.953'	24° 22.641'			636	
109	Margrette E	24/08/22	8:56	10:41	37° 23.191'	24° 23.748'	37° 23.174'	24° 24.112'	840-865	530
110	Margrette	24/08/22	11:02	12:13	37° 23.011'	24° 25.490'	37° 23.067'	24° 25.501'	847-837	100
111	Margrette	24/08/22	12:27	14:20	37° 22.989'	24° 25.883'	37° 23.094'	24° 25.688'	658-744	340
112	Margrette	24/08/22	14:38	15:32	37° 22.054'	24° 26.599'	37° 21.985'	24° 26.542'	640-	150
113	Margrette	24/08/22	16:01	17:03	37° 23.128'	24° 28.935'	37° 22.879'	24° 28.730'	391-411	550
114	Margrette	24/08/22	17:22	17:55	37° 22.170'	24° 29.852'	37° 22.058'	24° 29.889'	448-483	210
115	Margrette	24/08/22	18:05	18:56	37° 22.182'	24° 29.732'	37° 21.921'	24° 29.926'	439-543	560
116	Margrette	25/08/22	7:50	10:12	37° 19.265'	24° 24.036'	37° 18.823'	24° 24.664'	933-664	1230
117	Margrette	25/08/22	11:36		37° 19.897'	24° 25.963'	37° 19.736'	24° 26.046'	375-289	320
118	Formigas	25/08/22	14:51	15:51	37° 10.681'	24° 43.501'	37° 10.604'	24° 43.709'	827-840	330
119	Formigas	25/08/22	16:03	16:54	37° 11.758'	24° 43.738'	37° 11.647'	24° 43.972'	493-448	400
120	Formigas	25/08/22	17:06		37° 12.709'	24° 43.726'	37° 12.687'	24° 43.849'	272-307	180
121	Santa Maria SW	26/08/22	7:38	9:19	36° 53.761'	25° 08.939'	36° 53.890'	25° 09.277'	956-751	550
122	Santa Maria SW	26/08/22	9:31	11:11	36° 54.299'	25° 08.928'	36° 54.346'	25° 09.165'	697-567	360
123	Santa Maria SW	26/08/22	11:28	12:40	36° 55.361'	25° 07.690'	36° 55.733'	25° 07.302'	466-213	890
124	Santa Maria SW	26/08/22	13:12	14:14	36° 54.669'	25° 04.68'	36° 54.858'	25° 04.887'	604-521	460
125	Santa Maria SW	26/08/22	14:47	16:07	36° 53.193'	25° 02.704'	36° 53.369'	25° 02.758'	839-734	330
126	Santa Maria SW	26/08/22	16:51	18:08	36° 53.944'	25° 07.511'	36° 54.031'	25° 07.624'	801-737	230

St	Location	Date	Time		Start position		End position		Depth (m) start - end (m)	Dist.
			Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)		
127	Santa Maria SW	26/08/22	18:23		36° 54.978'	25° 09.128'	36° 55.163'	25° 09.284'	453-286	410
128	Santa Maria N	27/08/22	8:01	9:17	37° 3.805'	25° 01.705'	37° 03.444'	25° 01.404'	633-522	800
129	Santa Maria N	27/08/22	9:48	11:23	37° 04.740'	25° 02.751'	37° 04.617'	25° 02.732'	890-854	220
130	Santa Maria N	27/08/22	11:46	12:41	37° 04.355'	25° 03.969'			321	
131	Santa Maria N	27/08/22	13:14	14:24	37° 03.880'	25° 03.106'	37° 03.982'	25° 02.755'	497-425	550
132	Santa Maria N	27/08/22	14:59	15:51	37° 05.707'	25° 06.168'	37° 05.740'	25° 05.770'	417-477	590
133	Santa Maria N	27/08/22	16:32	17:24	37° 06.149'	25° 08.867'	37° 06.184'	25° 08.762'	754-736	160
134	Santa Maria N	27/08/22	17:52	19:35	37° 05.155'	25° 07.380'	37° 04.932'	25° 07.010'	459-304	680

Acknowledgments

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Leg 1

Slopes of Flores island, Diogo de Teive and Cachalote seamounts on board of the research vessel Arquipélago (with some dives around Faial, Pico and São Jorge islands)

Objective: to conduct a rapid appraisal of the deep-sea benthic communities dwelling on the slopes of Flores island and Diogo de Teive and Cachalote seamounts on board of the research vessel Arquipélago, together with some dives around Faial, Pico and São Jorge islands. These dives aim to contribute to the overall goal of better understanding the composition and diversity 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 62 dives with the Azor drift-cam down to 1000 m depth, covering 36.3 km of the seafloor and producing 60:33 hours of video footage, 3.31TB of disc space.

Vessel: RV Arquipélago

Dates: 06-23 July 2022

Scientific team: Telmo Morato, Sérgio Gomes, Luís Rodrigues, Guilherme Gonçalves, Inês Carneiro

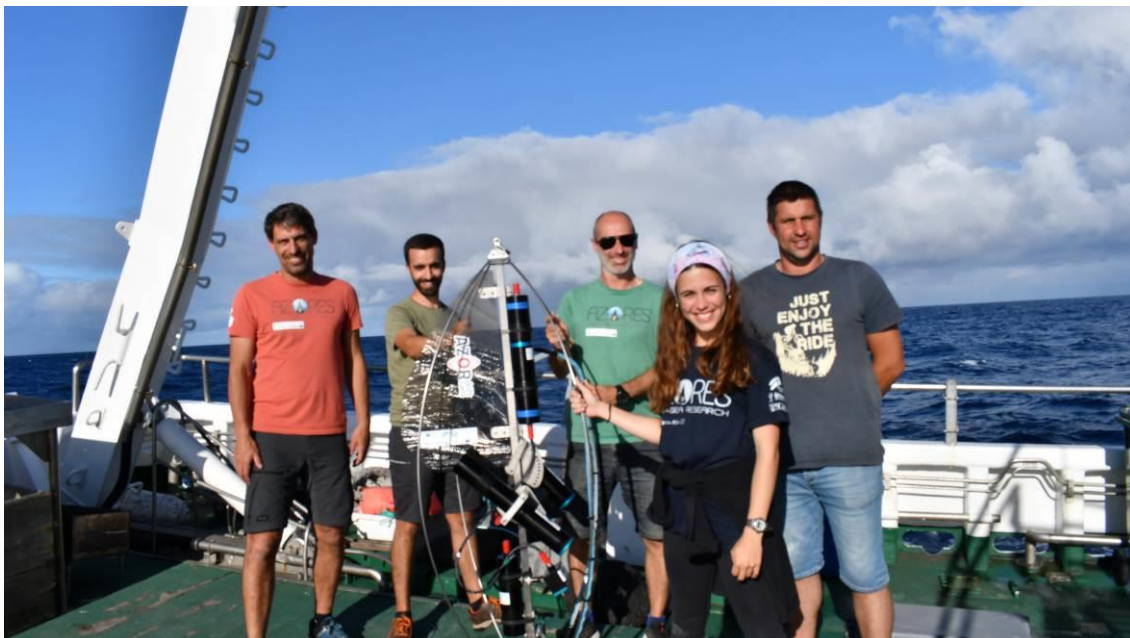


Figure 2. Scientific team on the RV Arquipélago that participated in the Leg 1 of the MapGES 2022 cruise.

Highlights:

1. Deep-sea exploration with the Azor drift-cam confirmed that Diogo de Teive seamount may classify as a near-natural or pristine area. The Portuguese Hydrographic Institute mapped this seamount in 2019 and found that it was much shallower than previous maps indicated. Because of the lack of known fishing events, we classified Diogo de Teive as a potential near-natural or pristine area. During the dives performed in Leg 1, we found many large and intact colonies of the coral *Callogorgia verticillata* that showed no signs of impacts from fishing activity, and we also encountered large schools of the wreckfish *Polyprion americanus*. More exploration may be needed, but this area should be kept in the list of priority areas for conservation in the Azores.
2. We were excited to explore the Cachalote seamount with the Azor drift-cam, after almost 4 years of waiting. The Portuguese Hydrographic Institute also mapped this seamount back in 2018 and revealed its flat-topped structure. The benthic communities showed a clear vertical stratification, with extensive gardens of *Narella bellissima* and *Narella versluysi* at depths between 700 m and 900 m, with areas characterized by the bamboo coral *Acanella arbuscula*. At 500-600 m depth, coral gardens of *Callogorgia verticillata* and *Viminella flagellum* were observed, together with many other species of corals and sponges. We also drifted over some alfonsinos, silver roughy, wreckfish, and saw lost fishing lines, both on the deeper dives and also on the summit. Although there were quite a few large *Callogorgia verticillata* colonies, many of them showed signs of fishing impacts, such as broken or missing branches.
3. We also explored the deep sea around Flores island, the westernmost point of the Azores and Europe, but siting on the North American Plate. We were stunned by two very dense patches of large pink and white bubblegum corals (*Paragorgia* cf. *johnsoni*) that resemble those observed in the Gigante Western Ridge. These areas are good candidates for breaking the record of the densest bubblegum coral garden in the Azores. The coral gardens seemed to be in reasonably good conditions, despite the fact that many colonies showed signs of impacts, some even found lying broken over the seafloor. We were also stunned by the diverse fauna colonizing the steep walls that can be found around Flores island, where large corals resembling *Paramuricea* were filmed, as well as by the diverse benthic communities observed with several species of corals and sponges, including *Acanthogorgia* sp., *Dentomuricea* cf. *meteor*, white and yellow *Viminella flagellum*, *Elatopathes abietina* and *Leiodermatium* sp.

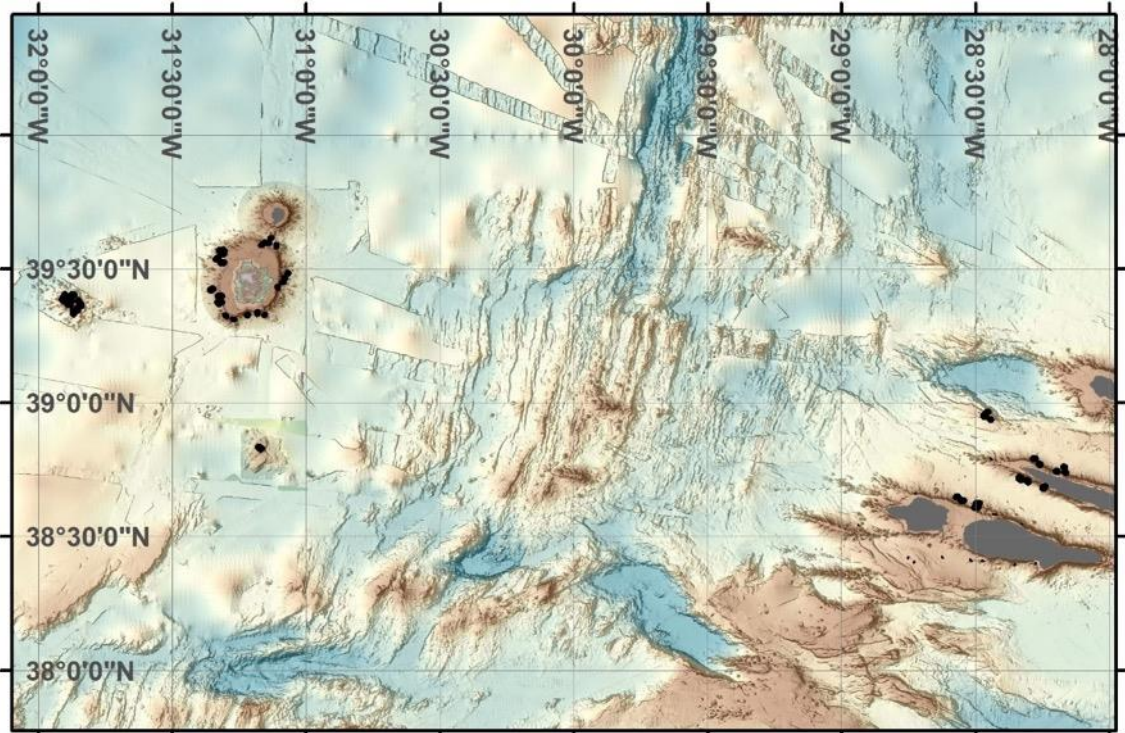


Figure 3. Location of the 62 video transects (black lines) carried out with the Azor drift-cam during Leg 1 of MapGES_2022.



Figure 4. Screenshots taken from the footage recorded during Leg 1 of MapGES_2022 cruise. (a) Large and intact colonies of soft coral *Callogorgia verticillata*. (b) Schools of wreckfish *Polyprion americanus*. (c) Aggregations of *Pheronema carpenteri*. (d) Vertical stratification with extensive gardens of *Narella bellissima* and *Narella versluysi*. (e) Coral garden with *Viminella flagellum*. (f) Orange roughly *Hoplostethus atlanticus*, a species rarely recorded. (g) Dense patches of large pink and white bubble gum corals *Paragorgia cf. johnsoni*. (h) Large corals resembling *Paramuricea*. (i) Diverse benthic community with *Acanthogorgia sp.*, *Viminella flagellum* and *Dentomuricea cf. meteor*.

Cruise Diary of Leg 1

06 July 2022

The first day of Leg 1 of MapGES 2022 cruise aimed to test and practice the operation of the Azor drift-cam before moving to more distant areas. Because the crew of RV Arquipélago is still 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 the north side of the Faial-Pico channel, where we performed 5 dives in the northern slopes of Faial-Pico channel. Most dives covered soft sediments with low biodiversity. However, in St01 some rocky outcrops with high densities of small sponges and corals were observed. We started transiting back to Horta at 17:45 and arrived at port at 18:20.



Figure 5. Map showing the dives conducted in the first day of Leg 1 of MapGES_2022 cruise in the northern slopes of Faial-Pico channel.



Figure 6. Screenshots taken from the video footage recorded during day 1 of Leg 1 of MapGES_2022 cruise in the northern slopes of Faial-Pico channel.

07 July 2022

This was the first day of real deep-sea exploration with the Azor drift-cam in 2022. We left Horta harbor at around 07:20 towards an area located between São Jorge and Graciosa islands, named Pico dos Rosais. We arrived at the sampling location at around 10:20 and performed 4 dives between 650 m and 900 m depth, mostly covering seafloor with soft sediments and low biodiversity, although some areas hosted high densities of *Narella bellissima* and *Narella versluysi*. A large wreckfish (*Polyprion americanus*) and one monkfish (*Lophius piscatorius*) were observed during the dives. We started transiting back to Horta at 17:45 and arrived at 20:40.

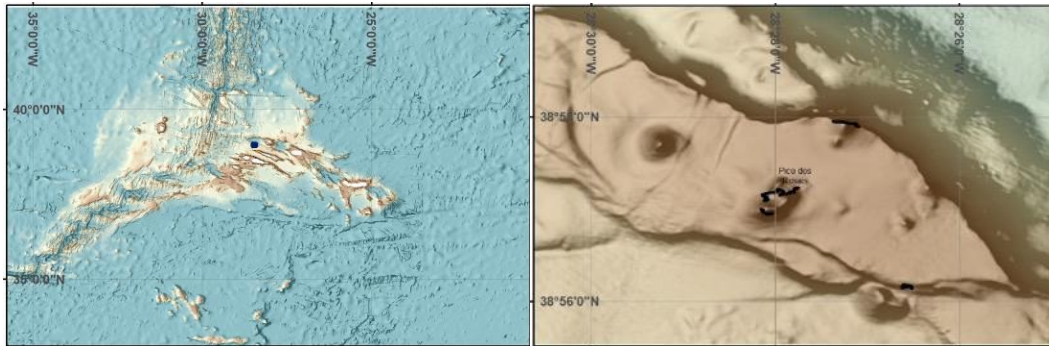


Figure 7. Map showing the dives performed in the area between São Jorge and Graciosa islands, named Pico dos Rosais.



Figure 8. Screenshots taken from the video footage recorded during the second day of Leg 1 of MapGES_2022 cruise in the area between São Jorge and Graciosa islands named Pico dos Rosais.

08 July 2022

We left Horta harbor at around 7:15, in direction of the southwestern slopes of São Jorge island. We started the first dive of the day at 9:30 on a deep ridge west of the municipality of Velas, where we found rocky outcrops covered by soft sediments. We conducted 5 dives with the Azor drift-cam throughout the day, between 200 and 950 m depth. Most of the steep slopes surveyed were covered by soft sediments, likely fallen from the small island shelf and possibly of a terrestrial influence. The benthic communities observed were dominated by small deep-sea sponges, with an aggregation of *Pheronema carpenteri* at 800 m depth being the highlight of the day. On shallower areas, we found some colonies of the endemic *cf. Errina dabneyi* and several kite fin sharks (*Dalatias licha*).

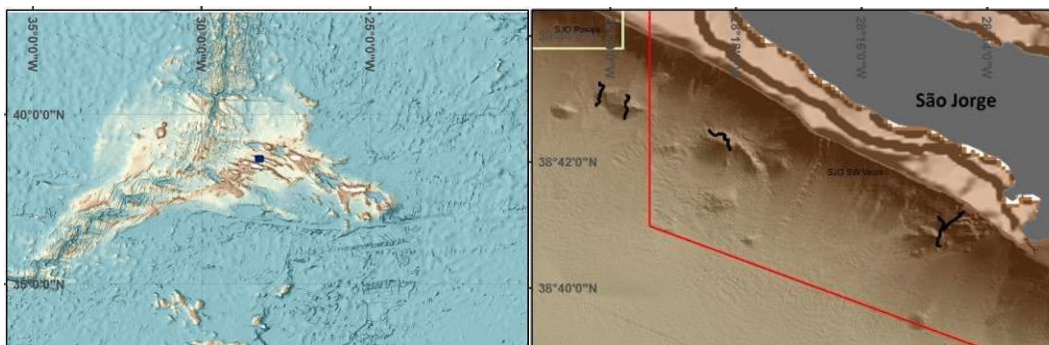


Figure 9. Map showing the location of the dives performed during day 3 of MapGES_2022 cruise in the southwestern slopes of São Jorge island.

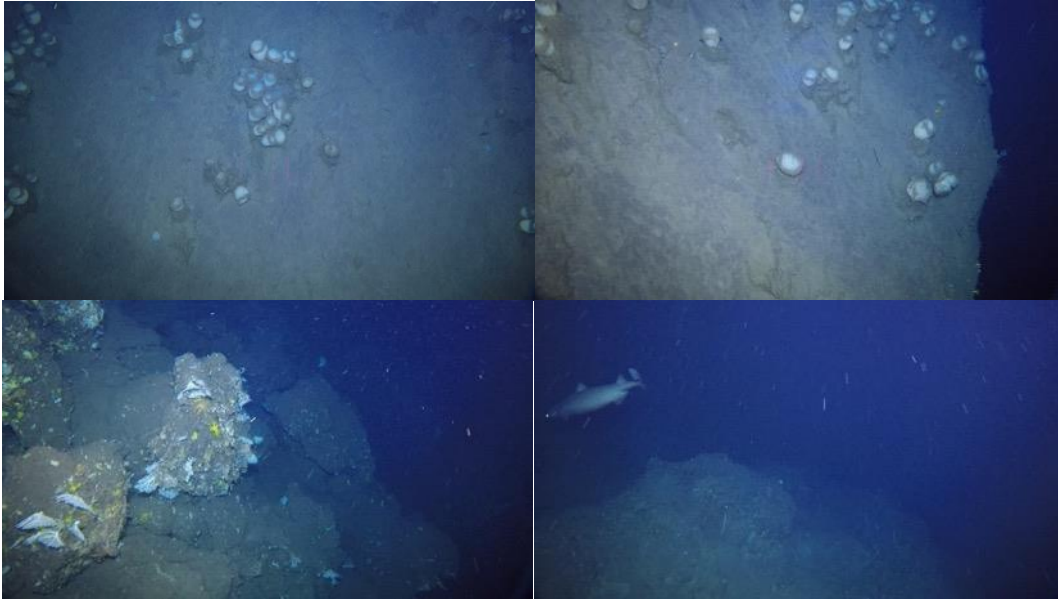


Figure 10. Screenshots taken from the video footage recorded during day 3 of Leg 1 of MapGES_2022 cruise in the southwestern slopes of São Jorge island.

11 July 2022

Since we were only able to operate during daytime in a limited area around Horta harbor, we decided not to work during the weekend. On Monday, we went back at sea to explore the northern shores of São Jorge island. We left harbor at 07:20 and arrived at the station at 10:00. We conducted 5 dives with a relatively good drift, especially in the morning, turning to almost no drift in the afternoon. On the third dive of the day, the Azor drift-cam got caught on a lost fishing longline. After a few attempts, we were able to release the system with only minor damage to the electric cable. The dives were conducted mostly on steep slopes covered by soft sediment with some bare rock in small portions of the dives. In general, we observed low biodiversity and low abundance of benthic species. One *Callogorgia verticillata*, some *Pheronema carpenteri*, an aggregation of (at least) 4 kite-fin sharks (*Dalatias licha*), one six-gill shark (*Hexanchus griseus*), and some corals at the end of the last dive were the highlights of the day.

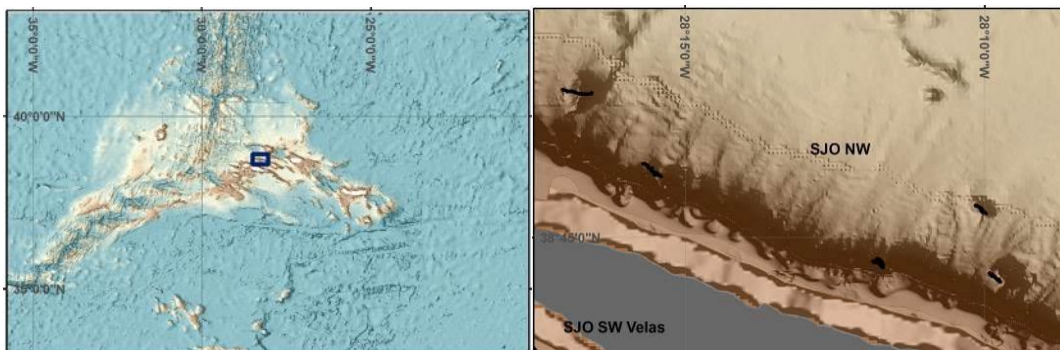


Figure 11. Bathymetric map showing the location of the dives from day 4 at in the northwestern slopes of São Jorge island.

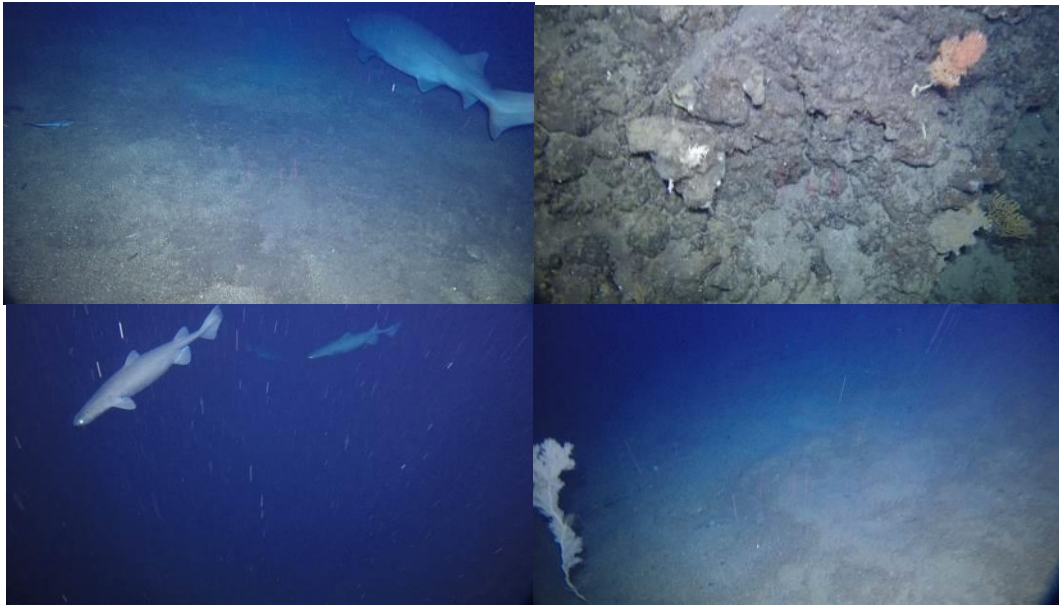


Figure 12. Screenshots taken from the video footage recorded day 4 of MapGES_2022 survey in the northwestern slopes of São Jorge island.

12-14 July 2022

We received green light to work away from Faial from July 15th since the crew decided to put their strike on hold until the end of August. The captain asked for a two-day break of the cruise to prepare the vessel with fuel and food supplies before heading to distant locations. We stayed in harbor the 12th and 13th of July.

15 July 2022

We left Horta at 00:15 towards Flores Island, on the westernmost side of the Azores. We decided to explore the Diogo de Teive seamount first, mapped by the Portuguese Hydrographic Institute in 2019. After the discovery that this small seamount was much shallower than previous maps indicated, it was defined as a potential near-pristine area due to the lack of known fishing events. After almost 15 h of transit, we started the first dive of the day at 15:00, and we conducted 3 dives between 640 m and 970 m depth. We had very good drift during the first and second dives, but turned to bad drift during the last. The small seamount was covered by soft sediments on most areas with only small patches of bare rocky outcrops. In general, the biodiversity and abundance of the benthic fauna was low. However, we found many large and intact colonies of soft coral *Callogorgia verticillata* with no signs of impacts from fishing activity. We also passed over several fields of the deep-sea sponges cf. *Asconema* and *Pheronema carpenteri*, and found a school of large wreckfishes of the species *Polyprion americanus*. The indication of intact colonies of large structuring corals, along with the lack of lost fishing lines and large schools of wreckfish, indicate that this seamount may classify as a near-natural or pristine area. After the last dive, we transited to Lajes das Flores and spent the night anchored outside the harbor.

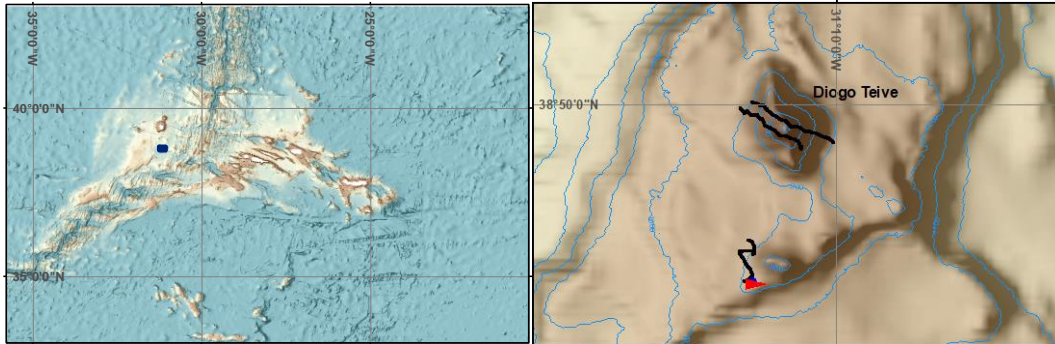


Figure 13. Map showing the location of the seamount and the position of the dives performed during day 5 of MapGES_2022 cruise in Diogo de Teive Seamount, south of Flores island.



Figure 14. Screenshots taken from the video footage recorded in Diogo de Teive seamount, south of Flores Island.

16 July 2022

Early in the morning, we transited to northwestern side of Flores island and conducted the first dive at around 08:30. The drift changed quite a lot during the day and most dives failed to reach the planned target. The fact that we are not able to direct the camera system towards a desired position is one of the drawbacks of the Azor drift-cam. Despite this problem, we were lucky to gather a lot of video footage useful to describe the deep-sea benthic communities of the area. We performed 5 dives between 1090 m and 400 m depth. In the first dive, we encountered a very dense patch of large pink and white forms of the bubble gum coral (*Paragorgia cf. johnsoni*) that resemble those observed in the Western Ridge of Gigante Seamount Complex (Morato et al., 2021¹). This coral garden was found in reasonably good conditions, despite the fact that many colonies showed signs of impacts, with some found lying over the seafloor. The second dive drifted on a kind of a canyon, mostly covered by soft sediments and with low diversity. The last dive

¹ Morato, T., Dominguez-Carrió, C., Mohn, C., Ocaña Vicente, O., Ramos, M., Rodrigues, L., Sampaio, Í., Taranto, G.H., Fauconnet, L., Tojeira, I., Gonçalves, E.J., Carreiro-Silva, M., 2021. Dense cold-water coral garden of *Paragorgia johnsoni* suggests the importance of the Mid-Atlantic Ridge for deep-sea biodiversity. *Ecol. Evol.* 11, 16426–16433. doi:10.1002/ece3.8319

of the day was performed between 600 and 400 m depth and drifted over patches of the black coral *Elatopathes abientia* and the whip coral *Viminella flagellum*. A large six-gill shark (*Hexanchus griseus*) came to inspect our system. During this dive, we found several lost fishing lines laying over the seafloor. After the last dive, we transited to Lajes das Flores and spent the night in the harbor.



Figure 15. Location of the dives conducted on the northwestern of Flores Island on July 16th.

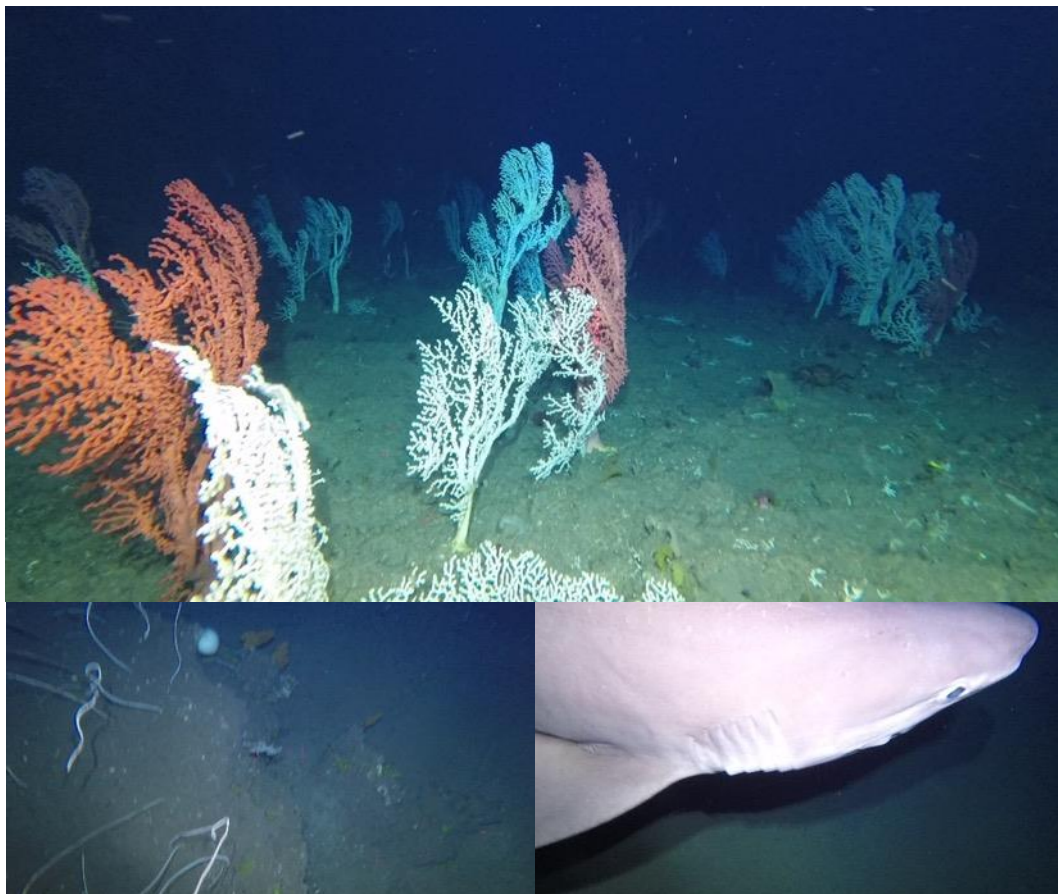


Figure 16. Screenshots taken from the video footage recorded on the northwestern part of Flores.

17 July 2022

We left Lajes das Flores in direction to the western side of the island, outside Fajã Grande, where we performed 6 dives between 500 m and 1000 m depth. The reduced wind did not help, and the erratic drift made us miss the target in some dives. We started at around 8:00, but the first dive was aborted due to the reduced. We repositioned the vessel on the top of a small mound and drifted over patches of

Viminella flagellum, growing on both sides of the summit. On the fourth dive, the bottom currents drove the Azor drift-cam into a small canyon eventually hitting a vertical wall. The camera system was vigorously pulled up during 3 minutes and 30 seconds against a 150 m height wall, before it was successfully released. Half-way through the escape, we lost live-view connection, but luckily it was only a connector being pulled out. We performed two more dives, and although we hit another steep wall, we mostly drifted over soft sediments and bare rock with low biodiversity. The Azor drift-cam survived another day in the “office” exploring the deep sea of the Azores. The highlights of the day were the few patches of *Viminella flagellum*, a monkfish (*Lophius piscatorius*), and the fauna observed on the vertical walls including several species of black corals, *Acanthogorgia* cf. *armata*, *Dendrophyllia cornigera*. After the last dive, we started transiting to Cachalote seamount, where we arrived at around 21:45.

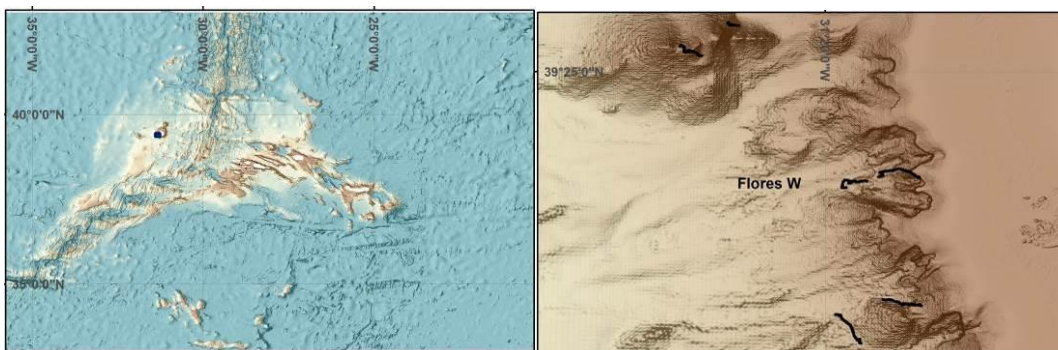


Figure 17. Location of the dives conducted on the western side of the Flores Island on July 17th.

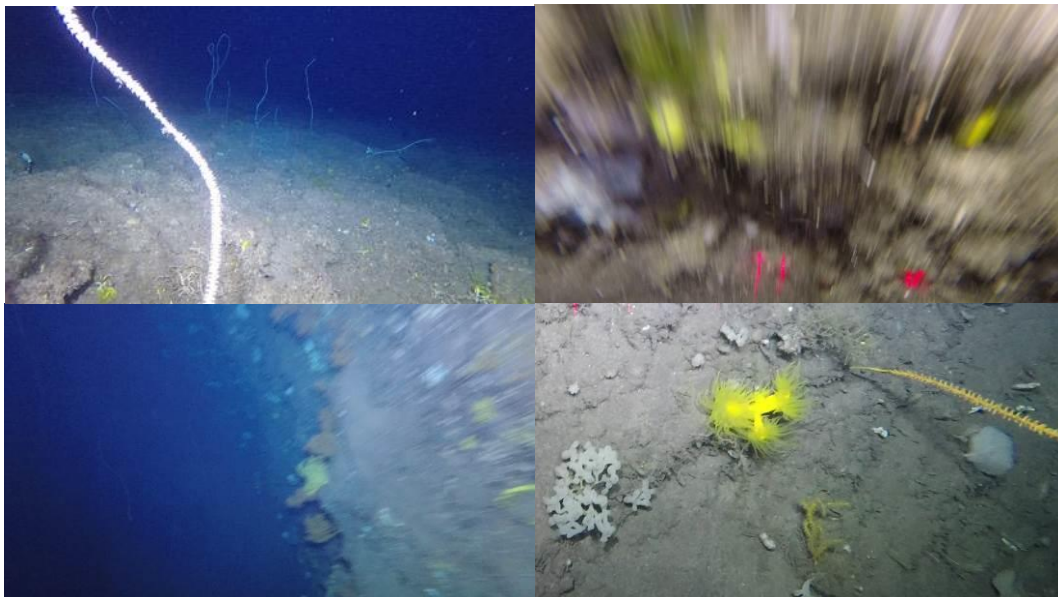


Figure 18. Screenshots taken from the video footage recorded on the western side of Flores island.

18 July 2022

The Portuguese Hydrographic Institute (IH) mapped Cachalote seamount back in 2018, allowing us to visit this seamount with the Azor drift-cam to explore its benthic communities. We were excited that we finally surveyed this area after trying to come here for 4 years. We spent the night over the seamount and started the first dive at 7:30. During the day, we performed 6 dives between 500 m and 1010 m

depth. The top and the slopes of the seamount are mostly covered by soft sediments, but with some rocky substrates. The benthic communities showed a clear vertical stratification, with gardens of *Narella bellissima* and *Narella versluysi*, and also of *Acanella arbuscula* at depths between 700 m and 900 m, and gardens of *Callogorgia verticillata*, *Viminella flagellum*, among many other corals and sponges, between 500 m and 600 m depth. We also drifted over some alfonsinos (*Beryx splendens*), silver roughy (*Hoplostethus mediterraneus*) and some lost fishing lines, both on the deeper dives and on the summit. Although there were some quite large *Callogorgia verticillata* corals, many showed signs of fishing impacts. We finished the last dive at around 20:30 and stayed in the Cachalote seamount to continue the survey the next day.

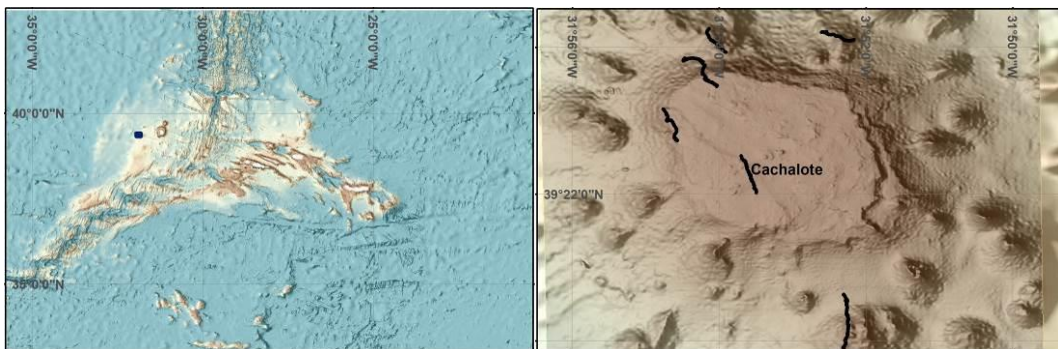


Figure 19. Map showing the location of the first deep-sea exploration done in Cachalote seamount with the Azor drift-cam.

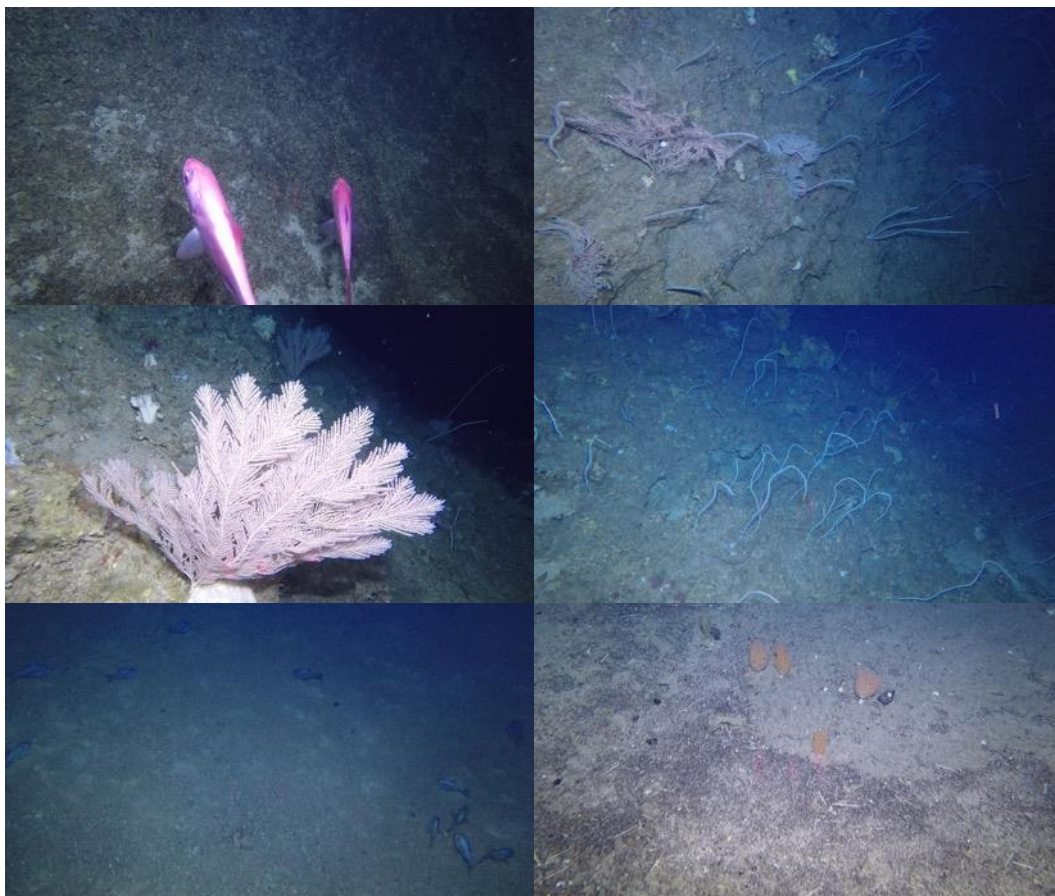


Figure 20. Screenshots taken from the video footage recorded during the first ever deep-sea exploration done in Cachalote seamount with the Azor drift-cam.

19 July 2022

We continued the exploration of the deep-sea habitats of Cachalote seamount to document its benthic communities. Today, we conducted 5 transects with the Azor drift-cam between 475 and 1022 m depth. In the first dive, we received the visit of a large wreckfish that slowly approached the camera. During the second dive, we noticed a small aggregation of *Paromola cuivieri* around a large sponge, both species frequently observed during the day. The benthic communities between 500 and 600 m depth mainly consisted of large gardens of *Viminella flagellum* along with sponges of the genus *Characella*, and some occasional corals of the species *Callogorgia verticillata*, as well as many other smaller coral and sponge species. The large abundance of lost fishing lines found on the seafloor was also noteworthy, together with other abandoned fishing gears. During the last dives of the day, we also spotted a large six-gill shark (*Hexanchus griseus*) curiously approaching our system, a couple of squids and a rarely recorded orange roughy (*Hoplostethus atlanticus*). We ended the last dive at 16:55 and started to transit to Flores island, where we spent the night outside Lajes das Flores harbour.



Figure 21. Second day of deep-sea exploration in Cachalote seamount with the Azor drift-cam.

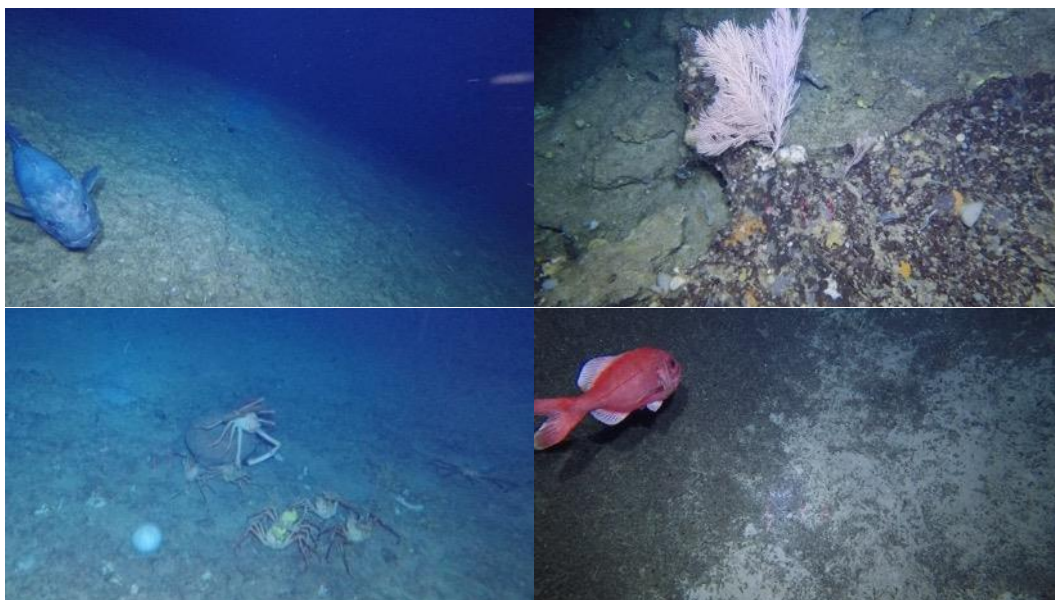


Figure 22. Screenshots taken from the video footage recorded during the second day of deep-sea exploration in Cachalote seamount with the Azor drift-cam.

20 July 2022

Early in the morning, we left Luís Rodrigues on land and started transiting to the first station at around 7:55. We spent the day exploring the southern slopes of Flores island, where we conducted 6 dives between 390 and 940 m depth. Many dives had poor drifts because the wind and prevailing currents were moving on opposite directions. In the first two dives, the camera drifted over soft bottoms with sparse fauna, including a few bamboo corals of the species *Acanella arbuscula*, sea urchins *Cidaris cidaris*, deep-sea crab *Chaceon affinis*, pink frogmouth fish *Chaunax pictus*, oilfish *Ruvettus pretiosus* and several bluemouth rockfish *Helicolenus dactylopterus*. Close to the summit of a small mound, we observed many large whip corals of the species *Viminella flagellum* together with *Anthomastus/Pseudoanthomastus* and the small black coral *Stichopathes gravieri*. We also conducted a shallow dive between 390 and 540 m depth, where we drifted over diverse benthic communities with *Acanthogorgia* sp., *Dentomuricea* cf. *meteor*, white and yellow *Viminella flagellum*, *Elatopathes abietina*, and large sponges of the genus *Leiodermatium*. After the last dive, we transited towards Santa Cruz harbor, where we spend the night just outside. During the day, we also had the chance to follow the first ROV dive of the NOAA Okeanos Explorer *Voyage to the Ridge* expedition, which was exploring a shallow portion of the Chaucer seamount complex, north of the Azores EEZ.

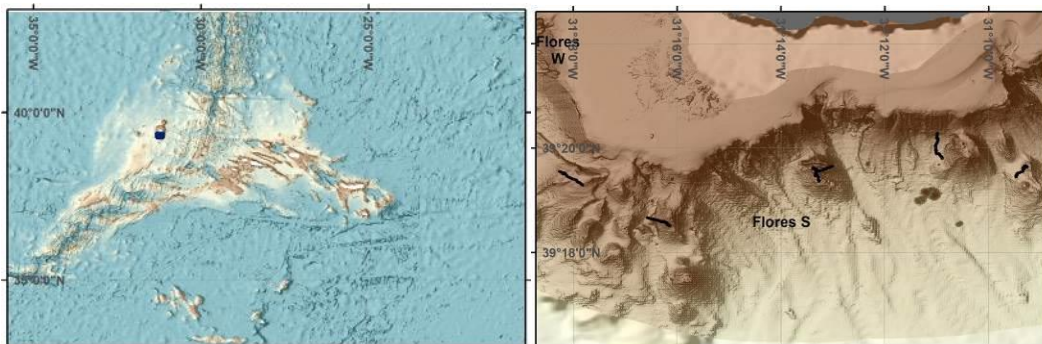


Figure 23. Third day of deep-sea exploration in Flores Island with the Azor drift-cam, where we spent the day in the southern slopes.



Figure 24. Screenshots taken from the video footage recorded in the southern slopes of Flores island with the Azor drift-cam.

21 July 2022

We transited to the northeastern side of Flores island to explore its deep-sea benthic communities. This area might be under the influence of higher current speeds generated by the channel between Flores and Corvo islands. During this day, we performed 6 dives between 350 m and 930 m depth. Unfortunately, the reduced wind and current speeds made the drift quite poor in many of the dives. We started the first dive at around 08:10 with a small incident; the electric cable got stuck on the boat and broke when coming out of water. On the third dive, we drifted towards a steep wall with dense patches of large corals resembling those from the genus *Paramuricea*. We also recorded dense patches of the bubblegum coral *Paragorgia* on the top of the wall, extending for quite some time. On the last dive, we drifted over a small mound between Flores and Corvo island, which was covered by an extensive garden of the scleractinian *Madrepora oculata* and some Stylasteridae corals, also with *Anthomastus/Pseudoanthomastus*, *Acanella arbuscula* and some *Leiopathes* sp. Along the day, we filmed several fish and shark species, such as *Hoplostethus mediterraneus*, *Helicolenus dactylopterus*, *Deania* sp., *Odontaspis ferox* and many Macrouridae. After the last dive, we transited to Corvo island, where we had the expedition dinner of Leg 1 in a local restaurant. During the day, we also dedicated some time to record short video clips for the local TV channel RTP-Açores showing the work performed during the cruise. We spent the night in Corvo harbor.

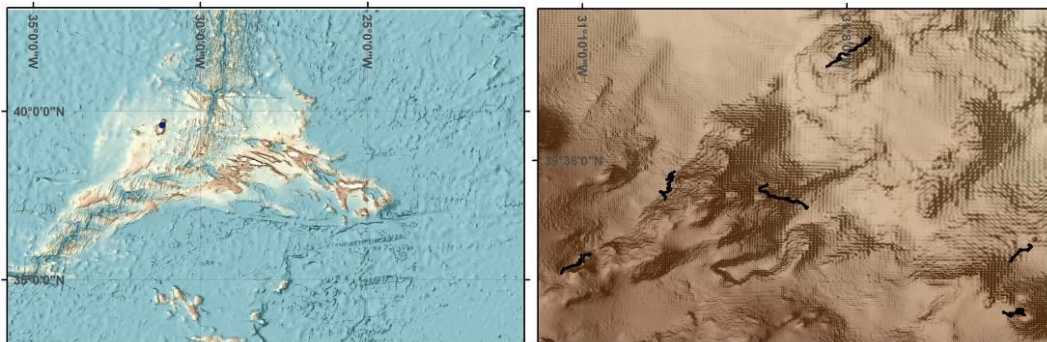


Figure 25. Location of the dives conducted with the Azor drift-cam in the northeastern Flores Island.

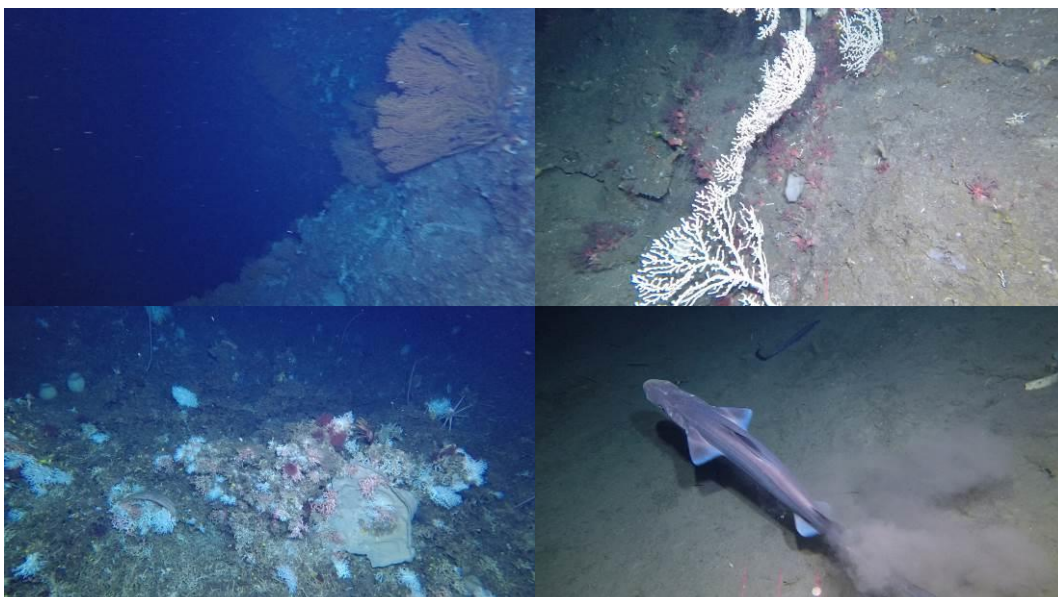


Figure 26. Screenshots taken from the video footage recorded with the Azor drift-cam in the northeastern side of Flores Island.

22 July 2022

We left Corvo at 6:30 and transited back to Flores Island to explore the deep-sea around Santa Cruz, in the eastern side of the island. During the day we performed 6 dives between 200 and 960 m depth. We finalized recording and sending the videos to the local TV channel RTP-Açores. The drift of the vessel was not ideal, with the exception of the last (and shallower) dive. In the deeper dives, we drifted over some soft sediment with sparse coral species including *Acanella arbuscula*. In the shallower dives, we crossed some diverse communities of corals and sponges with *Viminella flagellum*, *Dendrophyllia cornigera*, *Macandrewia azorica* and *Pheronema carpenteri*. We also drifted over several fishes including *Pagellus bogaraveo*, *Beryx* sp., *Hoplostethus mediterraneus*, *Helicolenus dactylopterus*, *Dalatias licha*, *Mora moro* and *Deania* sp. After the last dive, we washed the gear and packed the equipment, and started sailing back to Horta at around 17:15.

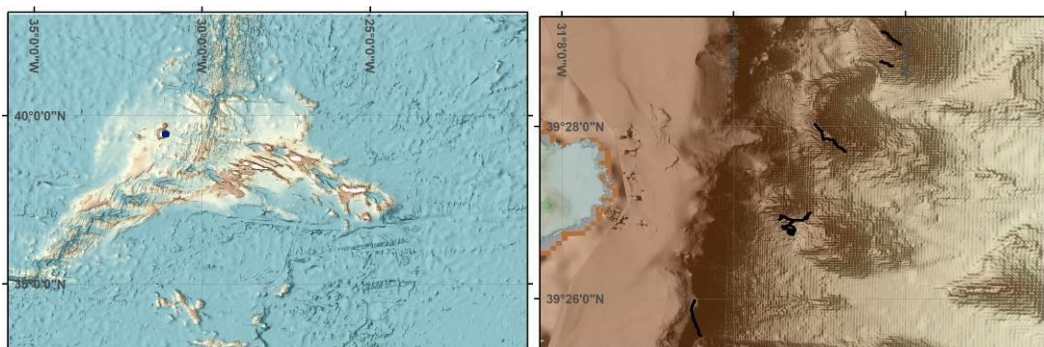


Figure 27. Location of the dives conducted with the Azor drift-cam in the northeastern slopes of Flores island.

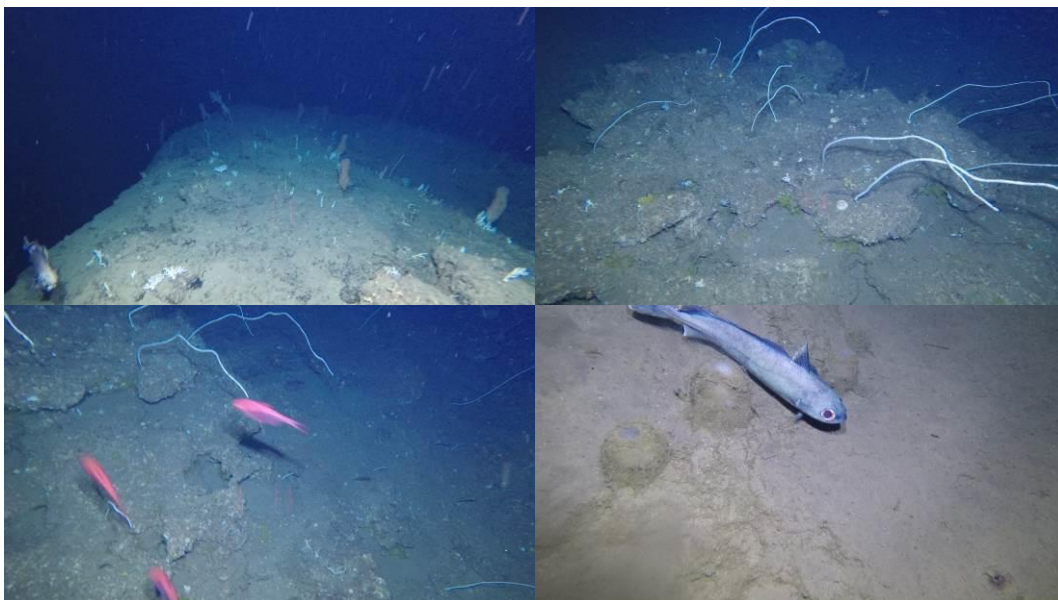


Figure 28. Screenshots taken from the video footage recorded with the Azor drift-cam in the northeastern side of Flores island.

23 July 2022

We arrived back to Horta harbor at around 8:30 and unloaded most of the gear back to our imagery workshop. We plan to be back at the sea on August 14th for the Leg 2 of the MapGES 2022 cruise.

Leg 2

Eastern Azores: seamounts between Faial and Santa Maria island (Albatroz do Meio, Girard Ridge, Maria Celeste), slopes of Santa Maria Island, and Formigas and Margrette seamounts

Objective: to conduct a rapid appraisal of the deep-sea benthic communities on seamounts between Faial and Santa Maria islands, including Albatroz do Meio, Girard Ridge and Maria Celeste, and also on the slopes of Santa Maria Island, and around the seamounts of Formigas and Margrette. These dives aim to contribute to the overall goal of better understanding the composition and diversity of the deep-sea benthic fauna of the Azores, the distribution of Vulnerable Marine Ecosystems (VMEs) and commercial fish species, and assess their environmental status.

Statistics: We performed 72 dives with the Azor drift-cam down to 1000 m depth, covering 35 km of the seafloor and producing 69:38 hours of video footage, 3.82TB of disc space.

Vessel: RV Arquipélago

Dates: 14 - 28 August 2022

Scientific team: Telmo Morato and Carlos Dominguez-Carrió (chief scientists), Sérgio Gomes, Luís Rodrigues, Guilherme Gonçalves, Manuela Ramos



Figure 29. Scientific team on the RV Arquipélago that participated in Leg 2 of the MapGES 2022 cruise.

Highlights:

1. Deep-sea exploration with the Azor drift-cam of several isolated seamounts located between the islands of Pico and Santa Maria (Albatroz do Meio, Girard, Maria Celeste) for which no information regarding their benthic communities was previously available. The images recorded revealed a diverse benthic ecosystem, characterized by (among several other assemblages) dense coral gardens of *Narella versluysi*, *Narella bellissima* and *Candidella imbricata*, aggregations of Stylasterids, large *Callogorgia verticillata* colonies and sponge grounds with the barrel sponge *Pheronema carpenteri*, as well as extensive areas with deposits of coral rubble.
2. We completed the first visual survey to the slopes of Santa Maria island, with a total of 30 dives carried out with the Azor drift-cam at depths between 200 and 1070 m depth, covering the whole perimeter of the island. The habitats explored host rich benthic communities, with black corals of the genus *Leiopathes* on its deepest areas, coral gardens of *Narella versluysi* and *Narella bellissima* and sponge grounds with *Pheronema carpenteri* at intermediate depths, and coral gardens with *Viminella flagellum* and *Callogorgia verticillata*, as well as aggregations of giant sponges of the genus *Characella*, in the shallowest areas explored, among several other assemblages.
3. We explored areas below 600 m depth inside the Marine Protected Area (MPA) of Formigas seamount to complete the exploratory work performed in deeper areas during the MedWaves cruise in 2016. The dives unveiled one of the largest and densest aggregations of the primnoid coral *Callogorgia verticillata* ever recorded in the Azores, which was found on the northern slopes of Formigas seamount. Although the area has been protected for several years, we were surprised by the amount of lost or abandoned fishing lines observed laying over the seabed.
4. We performed the first dives ever on Margrette seamount, the easternmost part of the Azores archipelago shallower than 1000 m depth, and hence that can be surveyed with the Azor drift-cam. Margrette seamount appeared to be a very complex area in terms of its geological morphology, with several vertical walls that complicated the exploratory work performed.
5. 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 with only minor damages. These collateral fishing impacts, i.e., preventing the acquisition of deep-sea biodiversity data to inform management deserves to be better quantified.

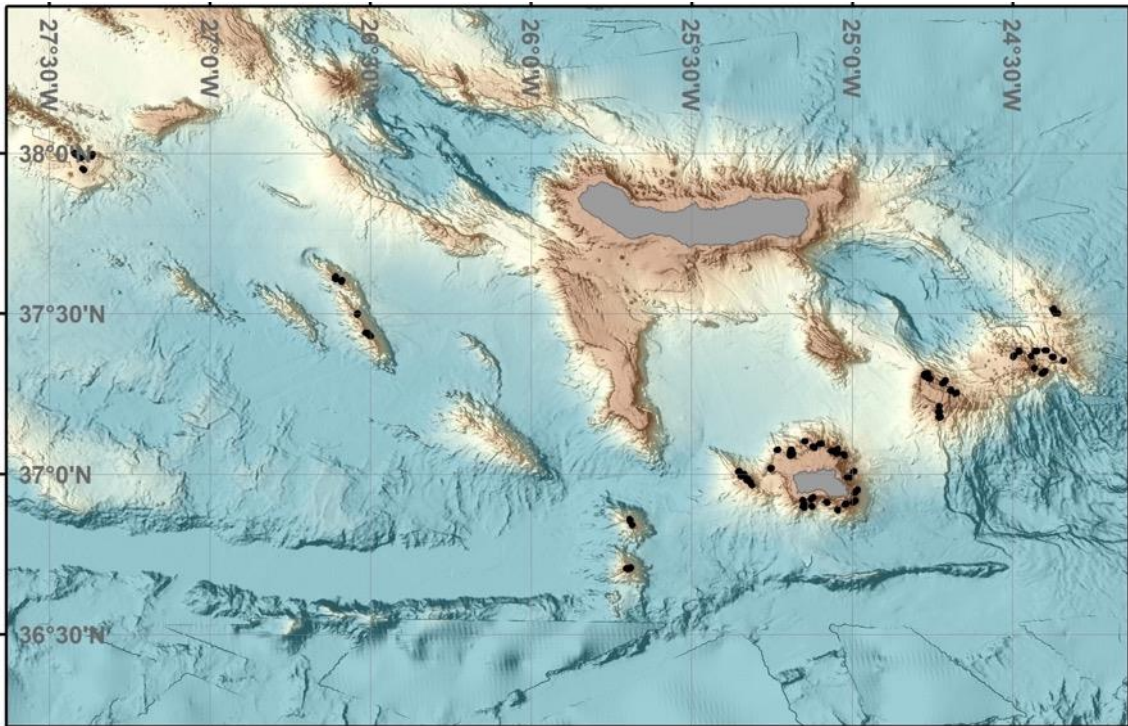


Figure 30. Location of the 72 video transects (black lines) carried out with the Azor drift-cam during Leg 2 of the MapGES_2022 cruise.



Figure 31. Screenshots taken from the footage recorded during Leg 2 of MapGES_2022 cruise. (a) Dense coral garden composed of the corals *Narella versluysi* and *Candidella imbricata*. (b) Aggregation of the barrel sponge *Pheronema carpenteri*. (c) Large and well-preserved colony of the primnoid coral *Callogorgia verticillata*. (d) A deep-sea shark swimming in front of the camera. (e) Dense aggregation of octocorals, likely from the genus *Paramuricea*. (f) A dense garden of the whip coral *Viminella flagellum*. (g) Sponge ground with several giant sponges of the genus *Characella*. (h) One of the several *Hemicorallium tricolor* colonies observed during Leg 2. (i) A black coral of the genus *Leiopathes* growing on a vertical wall.

Cruise Diary of Leg 2

14 August 2022

After finishing Leg 1 of MapGES_2022 on July 23 and the Eurofleets+ iMAR cruise on August 4, we are back at sea to explore deep-sea areas on the eastern side of the Azores, some of which have never been visually surveyed before. The first day of Leg 2 was employed to transit towards the first sampling station, located in an area named Albatroz do Meio, in the southeastern side of Pico island. We left Horta harbor at around 23:00 and transited for 70 nm during the night.

15 August 2022

We arrived to the seamount Albatroz do Meio at around 06:00 in the morning and started working with the Azor drift-cam at around 8:00. We conducted 7 dives between 580 and 910 m depth. Most dives were difficult to complete as initially planned since the wind and current directions did not provide good drifts. Many dives ended sooner because the camera system was moving down the slope or not moving at all over the seabed. The first area explored (St063-065) hosted very diverse benthic communities with patches of abundant coral gardens of *Candidella imbricata*, *Narella versluysi*, *Narella bellissima*, large stylasetrids and *Leiopathes expansa*, among many other species. Later in the day, we also drifted over patches of a community dominated by the barrel sponge *Pheronema carpenteri*, which was observed in association with the corals *Narella versluysi* and *N. bellissima*. The last dive was done at around 900 m depth, on a flat area covered by soft sediment and sparse benthic fauna. After this last dive (19:30), we started a 45 nm transit towards the next sampling location, the Girard ridge.



Figure 32. Location of the Albatroz do Meio and the dives conducted with the Azor drift-cam in this area.



Figure 33. Screenshots extracted from the video footage recorded with the Azor drift-cam in Albatroz do Meio.

16 August 2022

The day at Girard ridge started with a bit more wind and swell than the previous day. Nevertheless, we managed to conduct 3 dives on each of the two ridges, covering a depth range between 760 and 1040 m. All dives had a similar aspect, with extensive areas covered by coral rubble and encrusting sponges, large stylasterids and bamboo corals of the species *Acanella arbuscula* in the deeper areas. Coral gardens composed of *Narella versluysi*, *Acanthogorgia* sp., stylasterids, *Pseudoanthomastus* sp., and *Pheronema carpenteri* were found closer to the crests of the ridges. During the day, we drifted over some fish species such as *Trachyscorpia cristulata*, *Neocyttus helgae*, *Hoplostethus mediterraneus*, cf. *Lepidion guentheri*, *Epigonus telescopus*, cf. *Synaphobranchus kaupii*, macrourids, and a deep-water shark of the species *Pseudotriakis microdon*. After the last dive, we started a 58 nm transit towards the next sampling location, Maria Celeste seamount.

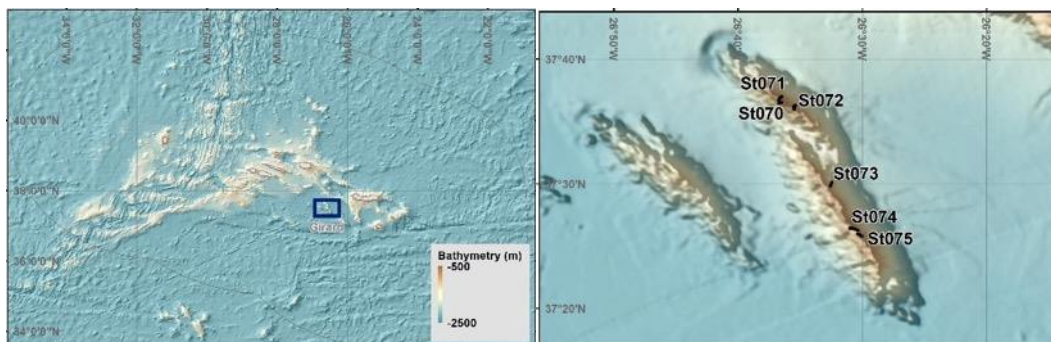


Figure 34. Location of the Girard ridge and the dives conducted with the Azor drift-cam in this area.



Figure 35. Screenshots extracted from the video footage recorded with the Azor drift-cam in the Girard ridge.

17 August 2022

Maria Celeste is an area with two perfectly star-shaped seamounts, with their bases at around 2500 m depth and their summits at depths as shallow as 580 m. Usually, this seamount-like structures originate quite strong currents circling around their peaks. We conducted 5 dives between 660 and 1000 m depth. The day started with some wind and swell while exploring the southern seamount of Maria Celeste. Here we found some quite large colonies of *Callogorgia verticillata* serving as shelter for small unidentified fishes. This seamount is also inhabited by some of the typical communities found at those depths, including the corals *Narella versluysi* and *N. bellissima* and *Acanthogorgia* sp. and the glass sponge *Pheronema carpenteri*. At around 14:00, we transited 8.5 nm to reach the northern seamount, where we performed two dives. The first dive targeted the southern part of the summit, and the second its northern side. In both dives, we drifted mostly over soft sediments, and the bare rock observed hosted sparse fauna. These seamounts seemed to have a quite distinct geology, and would deserve further examination by experts. After the last dive, we transited to Santa Maria island and spent the night in the local harbor.

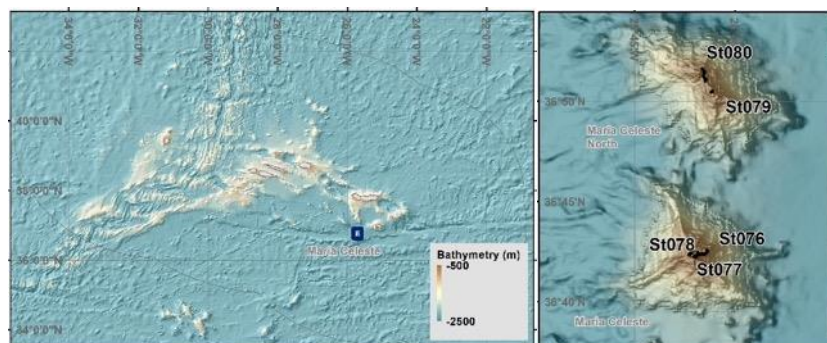


Figure 36. Location of the Maria Celeste seamounts and the dives conducted with the Azor drift-cam in this area.

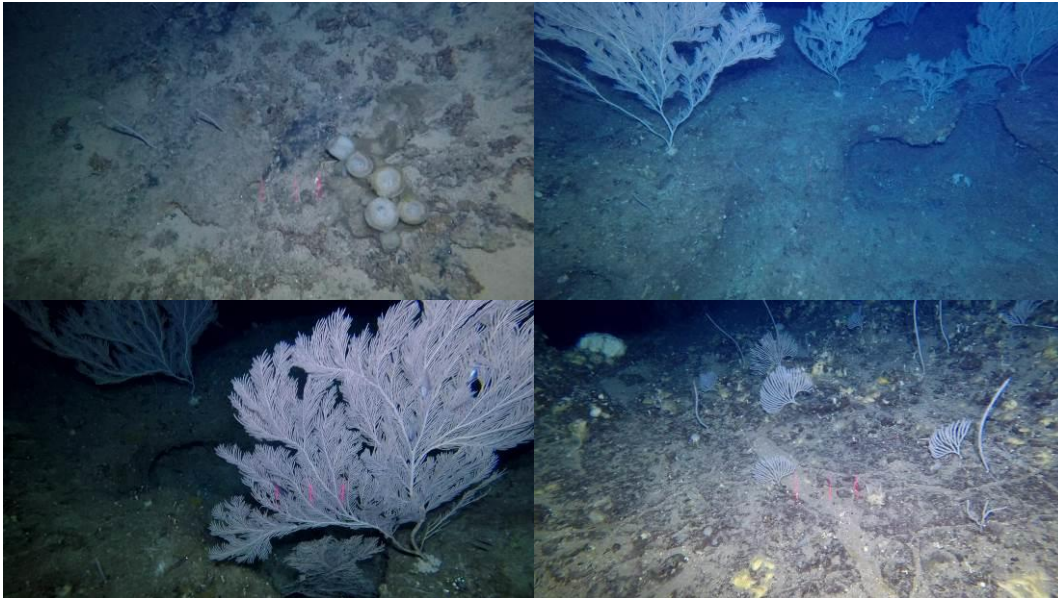


Figure 37. Screenshots extracted from the video footage recorded with the Azor drift-cam in the Maria Celeste seamounts.

18 August 2022

We left Santa Maria harbor at around 06:00 towards a small elongated seamount known as Pico Oeste. We conducted 5 dives with the Azor drift-cam between 550 and 1050 m depth. The first 3 dives had a reasonably good drift and allowed us to explore a significant area of the seamount. The first dive (560-660 m depth) covered soft sediments with *Acanthogorgia* sp. and silver roughly (*Hoplostethus mediterraneus*) before reaching rocky substrates with encrusting sponges. The small crest of this area was rocky with some large sponges (e.g. *Characella pachastrelloides*). The second dive was slightly deeper (1000 to 780 m depth), also starting over soft sediments with sparse fauna and some rocky substrates with few sponges. Closer to the crest, we drifted over a stunning, large, dense coral garden of *Narella versluysi* and *N. bellissima*, with *Acanthogorgia* sp. and the glass sponge *Asconema* sp. The third dive was slightly deeper (900 to 1060 m depth), drifting over a small crest with high density of *Hemicorallium tricolor*, cf. *Hemicorallium niobe* and stylasterids. In the last two dives of the day, the camera system did not drift much, and the SE area of the seamount was poorly explored. During the day, we also saw one six-gill shark (*Hexanchus griseus*), monkfish (*Lophius piscatorius*), cf. *Synaphobranchus kaupii* and bluemouth rockfish (*Helicolenus dactylopterus*). After the last dive, we went back to Santa Maria island to spend the night in the harbor.



Figure 38. Location of the Maria Celeste seamounts and the dives conducted with the Azor drift-cam in this area.



Figure 39. Screenshots extracted from the video footage recorded with the Azor drift-cam in Pico Oeste seamount, close to Santa Maria island.

19 August 2022

This day marks the official start of deep-sea exploration on the slopes of Santa Maria. The day was difficult because the currents and wind did not help, with the Azor drift-cam motionless over the seafloor in some dives, an important drawback of the system. We also have to acknowledge the lack of a detailed bathymetry for Santa Maria slopes, which prevented us from finding adequate sites for deployment. We conducted 6 dives between 200 and 1099 m depth in the northwestern slopes. The first 3 dives covered soft sediment with corals of the genus *Acanthogorgia*, sponge aggregations of cf. *Hyalonema* and *Pheronema carpenteri*, and shrimps of the species *Aristaeopsis edwardsiana*. The scleractinian *Flabellum* sp. and the octocoral *Paracalyptrophora josephinae*, as well as a dense patch of hydrozoans were observed in intermediate and shallow depths. We drifted over shallow-water fish, such as *Pontinus khulii*, *Scorpaena scrofa* and *Serranus cabrilla*, among others. St089 was the deepest ever conducted with the Azor drift-cam to date, with a maximum depth of 1099 m. Here, we mostly drifted over soft sediment, with a dense patch of *Candidella imbricata*, some *Acanella arbuscula*, *Antipathes erinaceus* and some unidentified Plexauridae on the rocky crest. We moved to a ridge (650 m depth) where we found a dense patch of *Callogorgia verticillata*, *Pleurocorallium johnsoni* and *Leptopsammia formosa* followed by a community with the sponges *Poecillastra compressa*, *Haliclona magna* and *Characella pachastrelloides*. In this ridge, we managed to get a close-up of a *Paromola cuvieri* carrying a *Callogorgia verticillata* on its back. After the last dive we transited back to Santa Maria harbor.

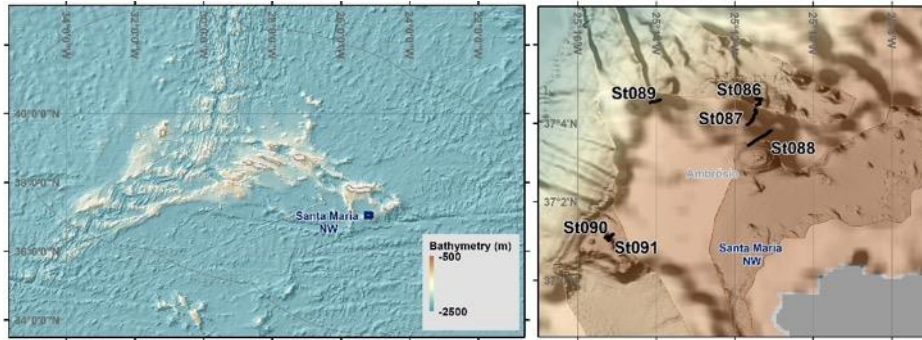


Figure 40. Location of the dives conducted with the Azor drift-cam in the northwestern slopes of Santa Maria Island.

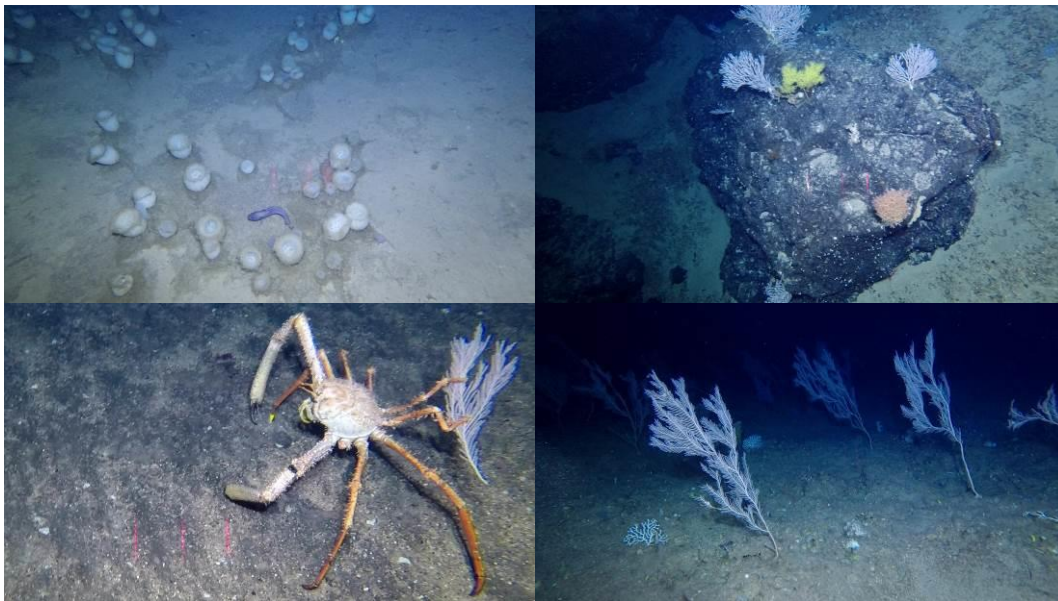


Figure 41. Screenshots extracted from the video footage recorded with the Azor drift-cam in the northwestern slopes of Santa Maria island.

20 August 2022

We left Santa Maria harbor at 6:30 in direction to the eastern slopes of the island. We chose this area to take advantage of the prevalent winds (NE) to optimize the drift of the camera system. During the day, we conducted 5 dives between 210 and 980 m depth. The first dive (St092) covered a large bathymetric range, but the seafloor was mostly covered by soft sediments with the sponge cf. *Hyalonema*, the cup coral *Leptopsammia formosa*, shrimps of the species *Aristaeopsis edwardsiana*, sea urchins *Echinus melo*, as well as silver roughy (*Hoplostethus mediterraneus*) and several rattails (Macrouridae). On the rocky outcrops on shallower waters, we found some octocorals such as *Acanthogorgia* sp., *Viminella flagellum* and *Callogorgia verticillata*. Station St093 was conducted at around 900 m depth over soft sediments with plenty of sand ripples and some *Cidaris cidaris*, *Aristaeopsis edwardsiana* and cf. *Synhaphobranchus kaupii*, *Chlorophthalmus agassizi* and one *Dipturus batis*. We also drifted over cf. *Hyalonema* and cup corals *Leptopsammia formosa*. Dive St094 (400-800 m depth) landed on a particularly rugged seafloor at around 800 m, rapidly covering steep terrain with gorgonians *Acanthogorgia* sp., cup corals *Leptopsammia formosa* and small aggregations of unidentified white Plexauridae hanging from the steep vertical walls, together with the sponges *Macandrewia azorica*, *Pheronema carpenteri*, *Stylochordilla pellita* and some large cf. *Stryphnus*.

Some tall *Viminella flagellum* colonies and *Callogorgia verticillata* appeared on the bare rock. We finalized the dive with a school of boar fish (*Capros aper*) at around 400 m depth. St. 095 covered a similar bathymetric range (400-800 m depth), with similar benthic species to those observed on the previous dive: *Acanthogorgia* sp., *Leptopsammia formosa*, unidentified hydrozoans, *Echinus melo*, white Plexauridae, and the sponges *Macandrewia azorica*, *Characella pachastrelloides*. In the upper slope, we also drifted over *Callogorgia verticillata* and *Viminella flagellum*. To finish the day, we made a shallow water dive (210-330 m depth), where steep rocks with a lot of sand on the flat areas were observed. The rocky areas were packed with large *Viminella flagellum* with some unidentified white Plexauridae. We also drifted over some nice *Callogorgia verticillata* and at least one *Paracalyptrophora josephinae*. In the last portion of the dive, we saw some *Anthias anthias* (or *Calanthias ruber*) and *Pontinus kuhlii*. After this dive, we transited back to Santa Maria island and for our MapGES 2022 Leg 2 break.

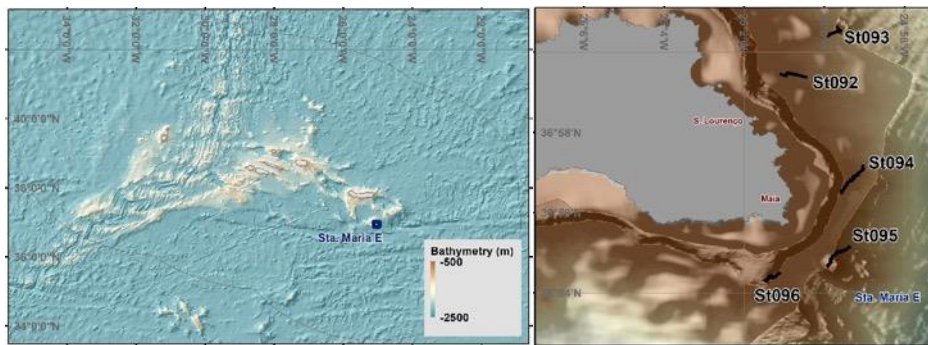


Figure 42. Location of the dives conducted with the Azor drift-cam in the western slopes of Santa Maria Island.

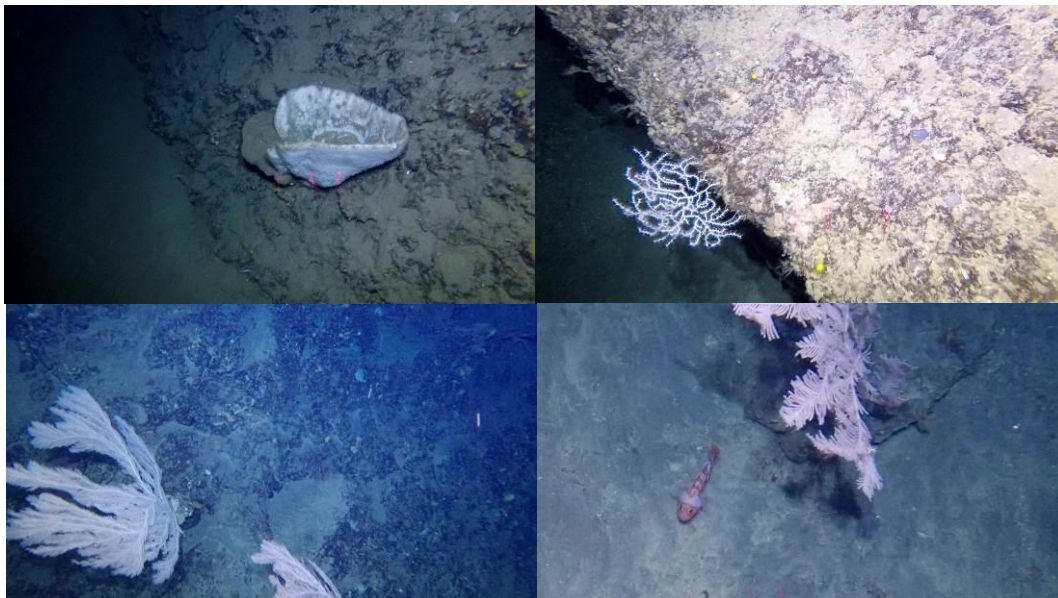


Figure 43. Screenshots extracted from the video footage recorded with the Azor drift-cam in the eastern slopes of Santa Maria Island.

21 August 2022

After one day of transit and 6 days of intense work at the sea, we stopped for our MapGES 2022 Leg 2 break. During the day, the scientific crew explored the beauties of Santa Maria island and relaxed in many of its bays and beaches. So far in this leg, we made 34 dives with the Azor drift-cam, covered 19.5 km of seafloor and stored more than 35 hours of video footage on our hard drives. The next portion of Leg2 will finalize the surveys around Santa Maria island and explore the Formigas Marine Protected Area (MPA) and adjacent seamounts. On the way back to Faial we plan to make one-day exploration in the Ferraria do Mar seamount if weather allows. We changed the chief scientist for the next phase of Leg 2, with the arrival of Carlos Dominguez-Carrió to Santa Maria. Telmo Morato left the cruise and flew back to Faial island.



Figure 44. Photos of the scientific team exploring the beauties of Santa Maria Island.

22 August 2022

We left harbor at 4 am in direction to Formigas Marine Protected Area. The deep-sea surrounding the islets had previously been explored during the ATLAS-MedWaves cruise with ROV Liropus. In that survey done in 2016, all sampling effort was placed between 500 and 1500 m depth, mostly in two areas located south east and north west of the MPA. During the day, we were able to conduct 6 dives between 270 m and 740 m depth, with one extra dive that had to be cut short just as we reached the seabed due to an entanglement on a fishing line (St101). Luckily, the system came back to surface in perfect conditions and operations could continue as planned. Due to the prevailing NE winds that blew during the day, dives were conducted on the northern sector of the MPA in order to maximize the time moving up the slope. The deepest areas explored during the day were generally of a sedimentary nature with eel-like fishes filmed crossing in front of the camera. When the rock outcropped, the fauna was characterized by several species of sponges, including encrusting desmosponges and also erect species such *Stylocordyla pellita*, *Maccandrewia azorica* and the giant sponge of the genus *Characella*, together with some glass sponges such as *Farrea occa* and the bird's nest *Pheronema carpenteri*. At those depths, octocorals of the genus *Narella* spp. were also reported. Moving towards shallower areas, the presence of octocorals was more relevant, with species of the genus *Acanthogorgia* and *Pleurocorallium*. The shallowest areas explored appeared to be richer in terms of diversity and abundance of coral species, with some octocorals becoming frequent as dives progressed, including *Viminella flagellum*, *Dentomuricea* aff. *meteor* and *Acanthogorgia* sp. The highlight of the day was the dense aggregation of large *Callogorgia verticillata* observed for several tens

of meters along the dive. Although all the dives made during the day were inside the limits of a Marine Protected Area, the number of encounters with fishing lines was relatively high. For instance, the second dive (St098) proved very difficult due to two entanglements in abandoned fishing lines at around 400 m depth. The Azor drift-cam overcame easily the first line, but during the maneuver to get free from the second line, the weight was lost and the dive had to be aborted. Dive 5 (St101) was also cut short after seeing some fishing lines hanging over the seabed crossing in front of the camera. Those areas were also home to some fishes, such as *Conger conger* and *Polypiron americanus*.

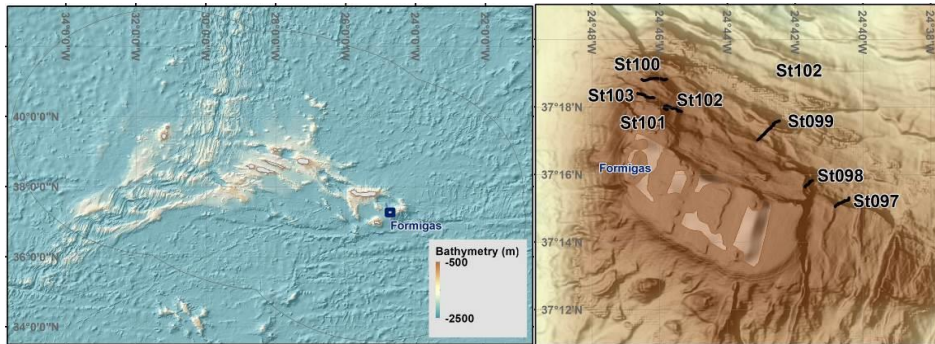


Figure 45. Location of the dives conducted with the Azor drift-cam in the northern slopes of Formigas MPA.

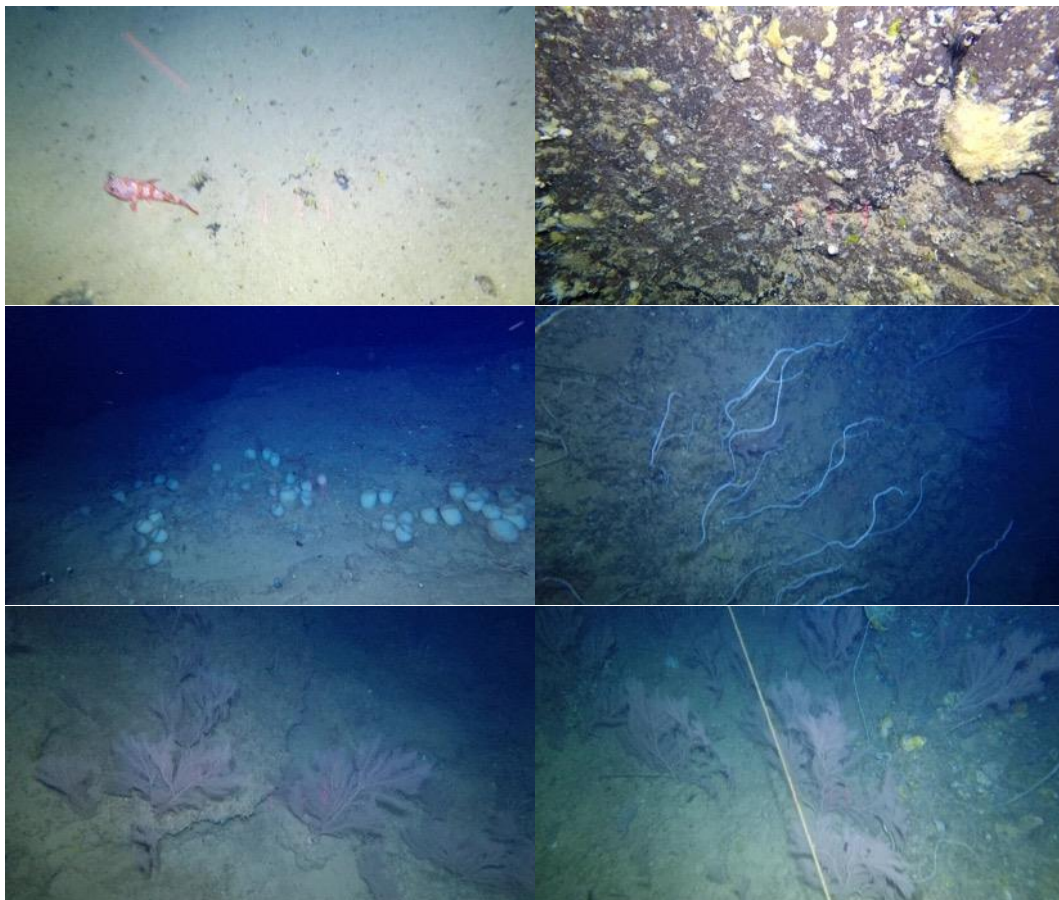


Figure 46 Screenshots extracted from the video footage recorded with the Azor drift-cam in the northern slopes of Formigas.

23 August 2022

After the dives done inside the MPA of Formigas, we moved towards a ridge located on the northeastern part of the Formigas complex. This ridge is relatively deep, with only a few areas with their summit above 800 m depth. Two dives were done in this area, both at depths below 700 m. In both dives, the camera system landed in sedimentary areas covered by coral rubble, but rapidly moving towards consolidated sedimentary rock. The rocks were characterized by the presence of octocorals of the genus *Hemicorallium* (*H. tricolor* and *H. niobe*), as well as some primnoids of the species *Narella versluysi*. Towards the end of the second dive, an aggregation of large plexaurids (likely of the genus *Placocorgia*) was observed.

After these two dives, we moved further south to explore the eastern part of Margrette seamount, an area with several flat terraces and very high vertical walls. The first two dives (St106-107) did not work well, with the camera system barely moving over the seabed due to constant changes of the drift of the vessel. To avoid losing the system, especially since the area to be explored had a high slope, both dives were aborted early for repositioning. The few images recorded showed coral rubble with several colonies of the genus *Narella*. We then moved towards a different area on the west, where the drift seemed to be more consistent. Dive St108 was planned in order to move upslope along a small ridge-like feature, but unfortunately the camera system got caught in an overhanging rock just when it was about to reach the summit. Although the crew of the vessel did everything they could to recover the system, with several attempts recovering and releasing cable, pushing and pulling in an attempt to get the cable free from the rock, we had to abort the recovery of the system until the next day. The low light conditions were not ideal for this type of operation. We placed some buoys with a sonar reflector at the end of the rope to mark its location and hoped that the changes in bottom currents due to the tides would make the recovery easier on the next day.

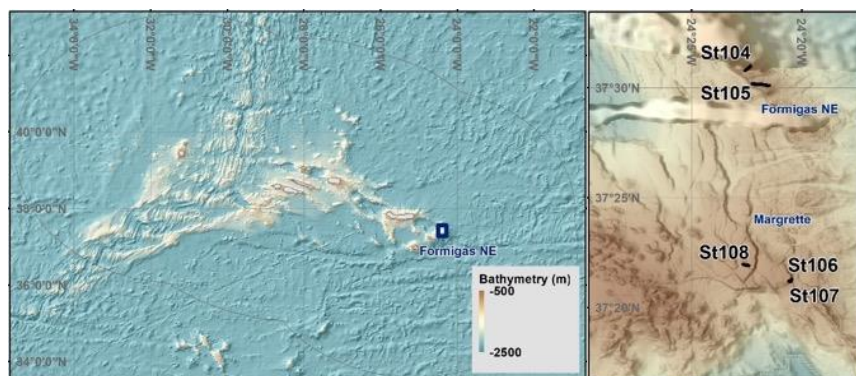


Figure 47. Location of the dives conducted with the Azor drift-cam in the elongated ridge on the NE part of the Formigas complex and in Margrette seamount. The system got entangled in dive St108, just as we were approaching the top of the feature.

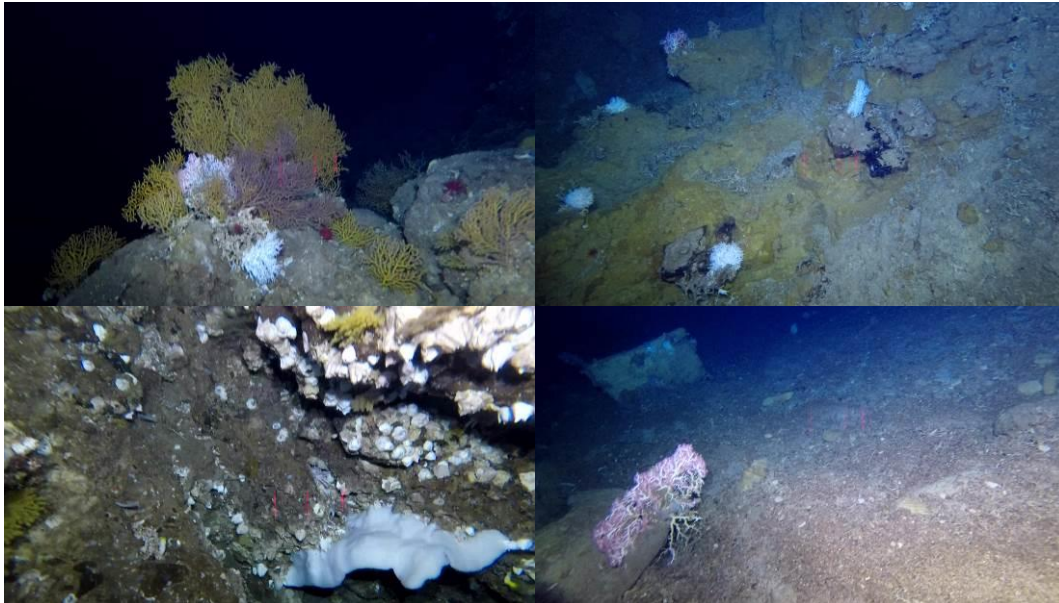


Figure 48 Screenshots extracted from the video footage recorded with the Azor drift-cam in the elongated ridge on the NE part of the Formigas complex and in Margrette seamount.

24 August 2022

The day started very early, in the position where the Azor drift-cam was lost the previous afternoon. After almost one hour of pulling and releasing rope by the crew of the vessel, also maneuvering the boat away from the area where the camera system was caught, the crew finally managed to set the system free and bring it back to surface. Luckily, no damage was done to any of the electronic components during the entanglement, and the drift-cam could be prepared again to continue surveying the deep sea as normal. The electronic cable, on the other hand, suffered severe damage in several positions along its length and had to be replaced for a spare cable brought to the vessel for these types of situations. Knowing that the complexity of the seabed in this area could potentially get the camera system entangled again, the first dive of the day (St109) was done in an area of a simple relief to check that everything was working correctly again. After this dive, the remaining dives were done moving progressively towards the west of the underwater feature, slowly approaching the summit of Margrette seamount. In the end, a total of 7 dives were performed during the day, although 2 of them were cut short (St110-114) due to problems with the drift that made the system remain static over the seabed or move at a very slow speed. In both situations, the Azor drift-cam was brought to surface to reposition the vessel and start a new dive. The deepest areas explored during the day, at around 800 m depth, hosted octocorals of the genus *Hemicorallium* (*H. tricolor* and *H. niobe*) and the glass sponge *Farrea occa*. Moving towards depths of 650-750 m, several species of octocorals (e.g. *Narella* spp., *Acanthogorgia* sp.) and sponges (e.g. *Pheronema carpenteri*, *Stylocordilla pellita*) started to be common, as well as the cup coral *Leptopsammia formosa*. The shallower areas (400-500 m depth) surprised us with a high number of sponge species, including those from the genus *Characella*, *Petrosia*, *Geodia* and *Haliclona*, in some sectors accompanied by the whip coral *Viminella flagellum*. Some crabs of the species *Paromola cuvieri* were observed carrying corals on their back. Several fishes were recorded in those dives, including the deep-sea shark *Dalathias licha* and some large *Polyprion americanus*.



Figure 49 Images taken during the recovery of the Azor drift-cam after getting entangled the previous day. The buoys were used to mark the position of the umbilical when left underwater overnight.

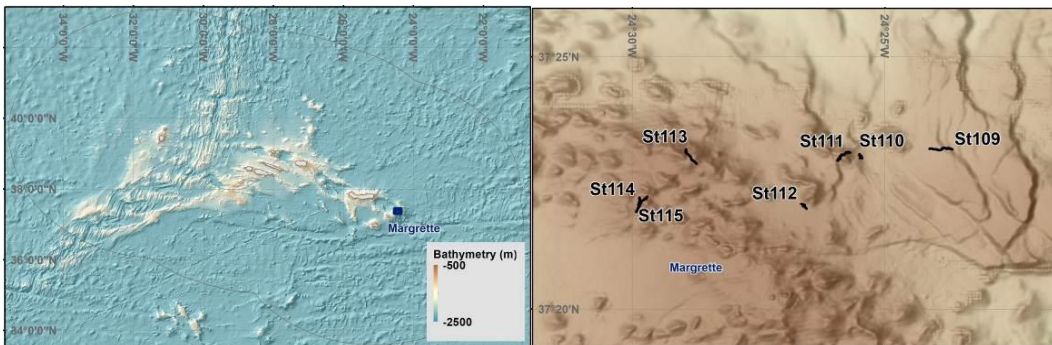


Figure 50. Location of the dives conducted with the Azor drift-cam in Margrette seamount.

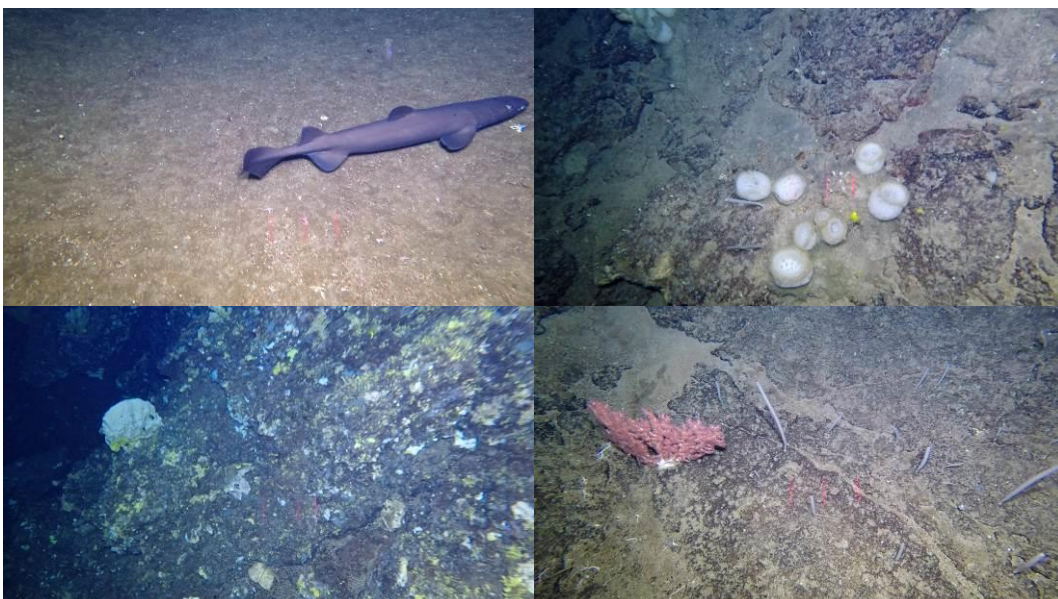


Figure 51 Screenshots of the dives conducted with the Azor drift-cam in Margrette seamount.

25 August 2022

The day was planned to perform two more dives in the eastern part of Margrette seamount before moving back again to Formigas MPA. The objective in Formigas was to explore the southern slopes, which could not be surveyed on 23rd August since all the work was focused on the northern side. The two dives in Margrette covered very different depth ranges, with the first dive at around 1000 m depth and the other at just 400 m. The unconsolidated substrates of the deep sector showed the typical fauna of such depths, including the corals *Acanella arbuscula* and *Chrysogorgia* sp., the sea urchin *Cidaris cidaris* and the oreo fish *Neocyttus helgae*. Moving further up the slope, when reaching harder substrates, different coral and sponge species were recorded, such as *Hemicorallium tricolor*, *Acanthogorgia* sp. and *Pheronema carpenteri*. Interestingly, the first dive uncovered an area with large pillow lavas, although little fauna was observed attached to them. Just a few minutes before the first dive ended, the system got caught in a lost fishing line. Luckily, with just some maneuvering of the Azor drift-cam up and down the water column, the line was overcome and the system could be brought to surface in perfect conditions. The shallowest areas explored hosted a large number of colonies of the primnoid *Callogorgia verticillata*, although this time with broken branches and dead colonies lying flat over the seabed, likely signs of fishing activity. In fact, several long lines were observed over the course of the dive, some of which with epibionts growing on top of them, indicating that they could have been there for a long time.

After working in Margrette seamount, we headed towards the southern sector of Formigas, sailing for around 30 nm. The three dives done in Formigas were planned along an elongated ridge, starting on its deepest part (below 950 m depth) and moving upslope. The rocks observed on the deep areas hosted typical fauna from those depths, with glass sponges and a few black corals. Very rapidly, the community shifted to one dominated by the bird's nest *Pheronema carpenteri* together with the glass sponge *Farrea occa* and some octocorals such as *Acanthogorgia* sp. Moving towards shallower areas, the community shifted to giant sponges of the species *Characella pachastrelloides* together with the whip coral *Viminella flagellum*, in some areas making some high-density patches. The dives ended at 17:30, when we had to head back to Santa Maria to be in harbour before 21:00.



Figure 52. Location of the dives conducted with the Azor drift-cam in Margrette and Formigas seamounts.



Figure 53 Screenshots extracted from the video footage recorded with the Azor drift-cam in Margrette and Formigas seamounts.

26 August 2022

After spending the night in Santa Maria island, the dives started early in a location in front of Vila do Porto. Due to the low winds forecasted for the day, the dives had to be done according to tidal currents, which could produce unpredictable drifts that changed during the day. Luckily, all 7 dives performed followed the expected path over the seabed, most of the time moving up slope and facilitating the work. The depth range surveyed was as large as possible, with dives from 1000 m depth to below 300 m. The fauna observed in the deepest areas was typical from those depths, including the bamboo coral *Acanella arbuscula* and a variety of eel-like fishes in soft sediments. Hard substrates hosted a more diverse faunistic composition, with black corals (e.g. *Leiopathes* sp.), stylasterids, cup corals (e.g. *Leptopsammia formosa*) and glass sponges (e.g. *Hyalonema* sp., *Farrea occa*). The intermediate depths were characterized by a large diversity of sponges, from a variety small encrusting species to large erect individuals, such as *Stryphnus* sp., *Maccandrewia azorica*, *Stylocordilla pellita* and *Petrosia* sp. At those depths, aggregations of octocoral species were also observed, including those formed by the primnoids of the genus *Narella* and by *Acanthogorgia* sp. The shallowest areas were relatively poor in terms of fauna, besides some areas with the whip coral *Viminella flagellum*, aggregations of hydroids in soft sediments, and accumulations of dead algae in the shallowest depths surveyed, probably transported from littoral areas.

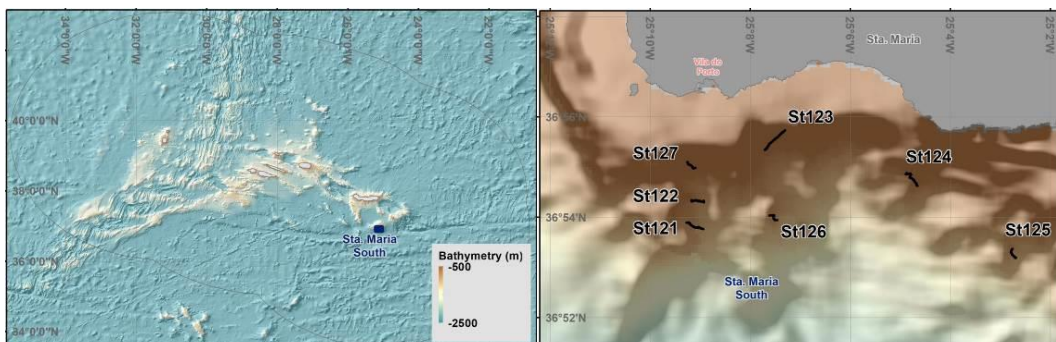


Figure 54. Location of the dives conducted with the Azor drift-cam in in the SW sector of Santa Maria.



Figure 55 Screenshots extracted from the video footage recorded with the Azor drift-cam in the SW sector of Santa Maria.

27 August 2022

The last day spent in Santa Maria was employed to explore the NE sector of the island, which completed all areas planned for this cruise. The day was intense, with another 7 dives performed between 300 and 900 m depth. Overall, the drift allowed most transects to be performed as expected. The deepest areas were generally of a sandy/muddy nature, with eel-like and macrourid fishes and little epifauna besides *Acanella arbuscula* and pedunculated glass sponges. However, when the rock outcropped, the diversity increased rapidly, with several of the common species observed at depths of 1000 m, which included black corals of the genus *Leiopathes*, octocorals of the genus *Hemicorallium*, cup corals of the species *Leptopsammia formosa* and several species of glass sponges. Moving towards shallower areas, the diversity and abundance of sessile species increased, with hard substrates characterized by high abundances of sponges, most of them of a small size and encrusting, but also with several erect species, such as *Characella pachastrelloides* and *Stylocordilla pelita*. One of the dives hosted a very dense aggregation of the octocoral *Candidella imbricata*, in most cases attached to the edges of the rock, likely in the search of better feeding conditions. The whip coral *Viminella flagellum* was also relatively common, generally accompanied by other octocorals such as the primnoid *Callogorgia verticillata* or a white ramified plexauridae not yet identified to species level. The soft sediments were generally colonized by large hydrozoans not yet identified to species level, as well as by scleractinians of the genus *Flabellum*, this last species generally in low abundances. Several abandoned fishing lines were observed in many of the dives, especially those performed in shallower areas. In fact, the system got entangled in a fishing line that was hanging above the substrate (St131), but it rapidly got free just by recovering umbilical and making the line pass below the structure. No damage was reported during this entanglement. The last dive finished just after 19:30, and we started to head back towards Faial with the objective of arriving at Ferraria do Mar seamount early in the morning to start surveying this unexplored area. The weather forecast was not promising, with NW winds of 15-20 knots expected to be blowing all day next day.

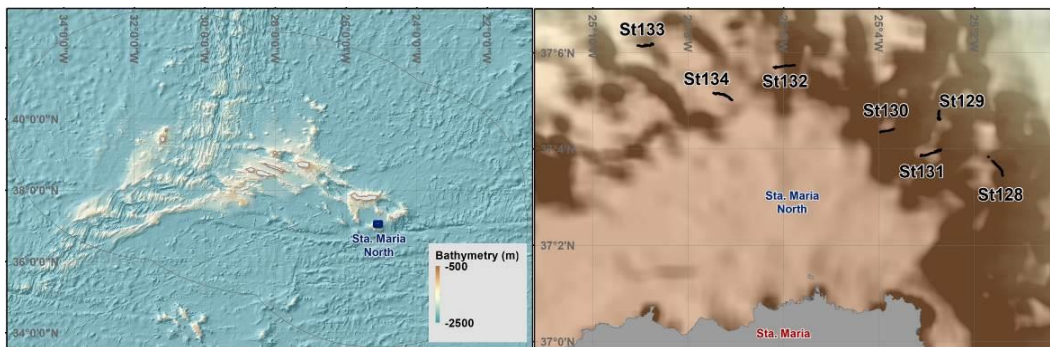


Figure 56. Location of the dives conducted with the Azor drift-cam in the NE sector of Santa Maria island.



Figure 57 Screenshots extracted from the video footage recorded with the Azor drift-cam in the NE sector of Santa Maria island.

28 August 2022

The weather forecast correctly predicted the wind conditions for the day. As expected, we had moderate winds against the ship's bow that together with the 1.5-2 meter waves reduced the normal sailing speed of the vessel to around 6-7 knots. We reached Ferrara do Mar seamount later than expected. The sustained winds and the high waves generated very difficult conditions to attempt any type of deployment with the Azor drift-cam. Hence, we decided to continue sailing towards Faial and bringing the cruise to an end. We arrived at Horta harbor at around 19:30. We packed all the equipment during the transit to Horta so we could unload it and take it back to the imagery workshop on the following day.



Figure 58 The vessel getting into the port of Horta after a long transit between Santa Maria and Faial islands, with rough sea conditions almost all along, and that led to an early conclusion of this year's MapGES_2022 cruise.



Figure 599 Scientific team and vessel crew of RV Arquipélago that took part in Leg 2 of MapGES 2022 just as we arrived to Horta harbor.

29 August 2022

At 9:00 in the morning, the scientific team gathered again on the vessel to transport all the equipment back to our imagery workshop located in the university facilities. In less than 2 hours we had everything out of the vessel, and could spend the remaining part of the day organizing the equipment and preparing the inventory for the next cruise.



Figure 60 The scientific team unloading the equipment of the vessel to take it back to the workshop.

“Life” on board RV Arquipélago during MapGES 2022 Leg1

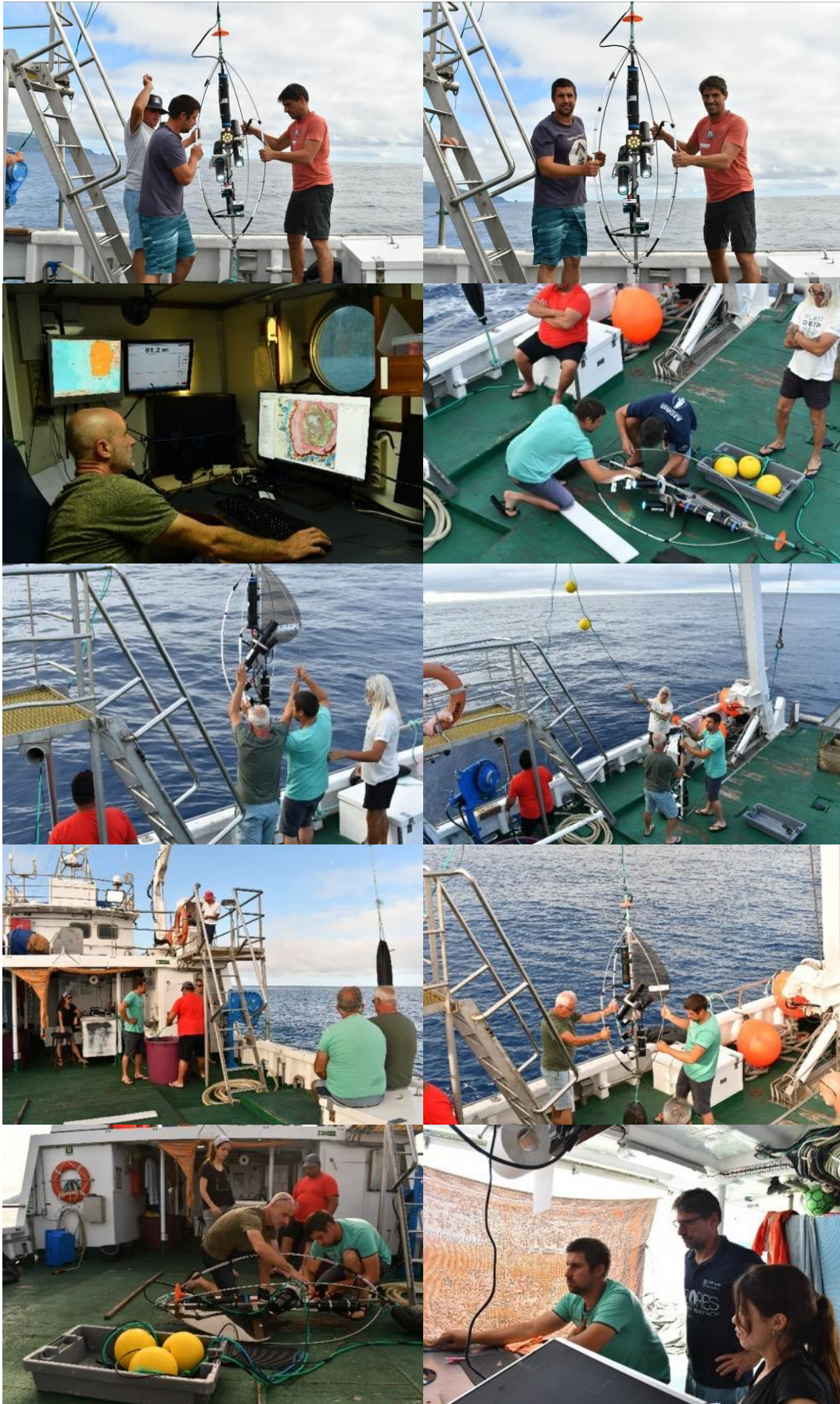




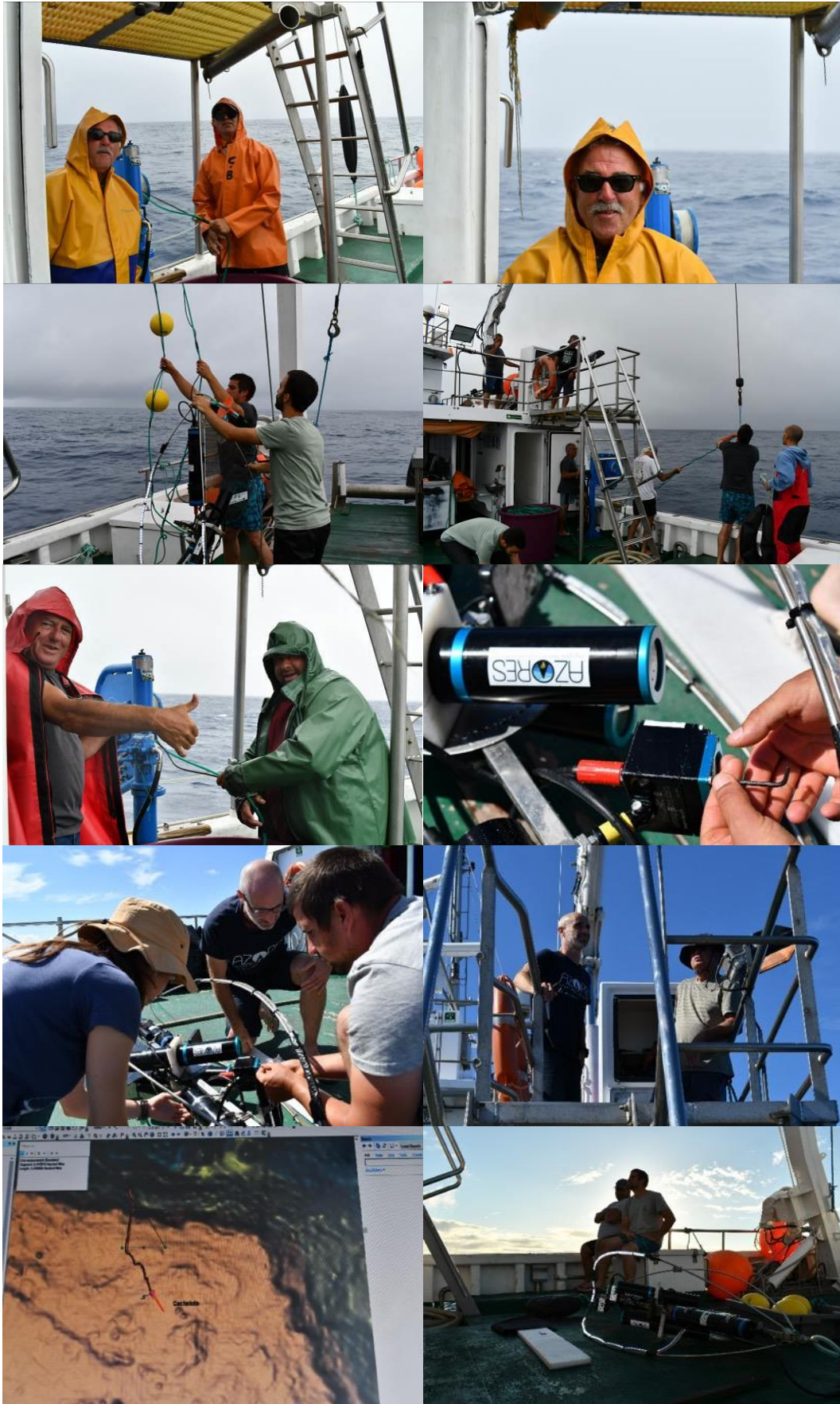








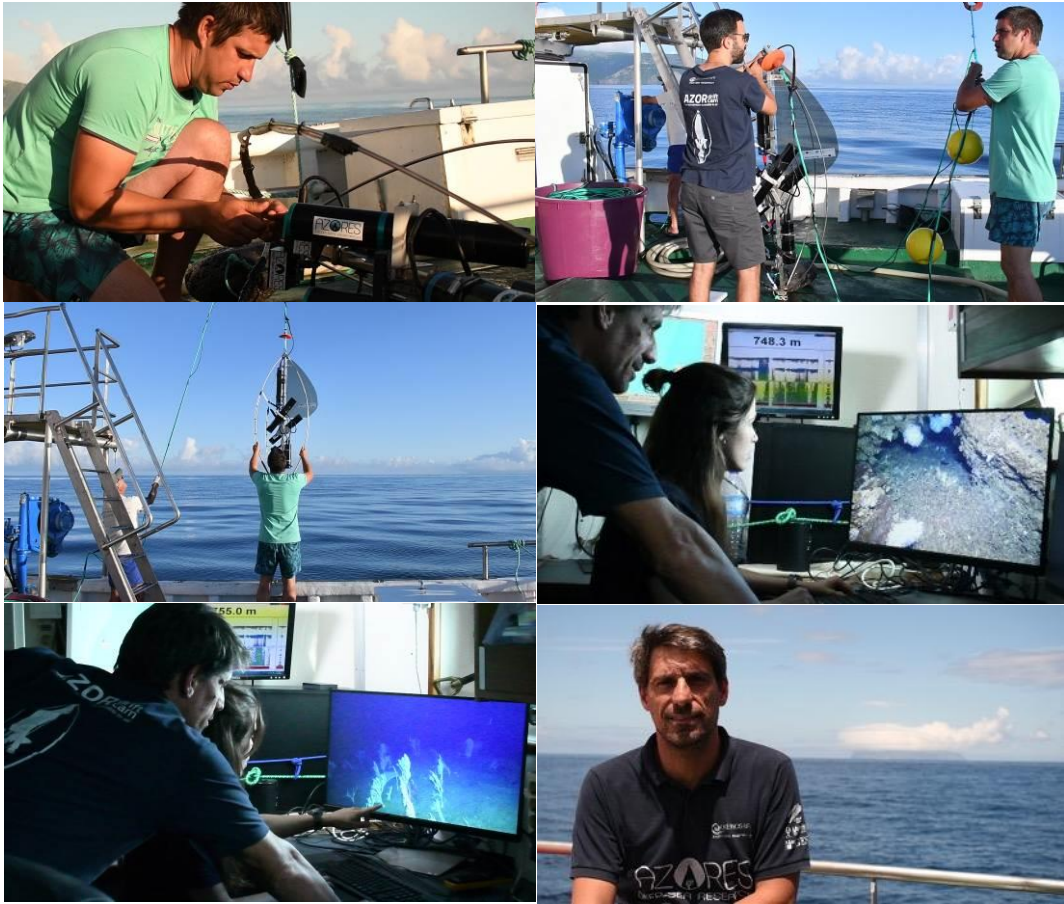












“Life” on board RV Arquipélago during MapGES 2022 Leg2

