AZORES
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MAPGES 2023 CRUISE REPORT: EXPLORATION AND MAPPING OF DEEP-SEA BIODIVERSITY IN THE AZORES ON BOARD MT PHYSETER

AJUSTE DIRETO N.º 11/DRPM/2022 - CARACTERIZAÇÃO DOS HABITATS DE PROFUNDIDADE, COM VISTA AO SEU MAPEAMENTO ATÉ AO LIMITE EXTERIOR DA SUBÁREA DOS AÇORES DA ZONA ECONÓMICA EXCLUSIVA PORTUGUESA

MapGES 2023 cruise report: Exploration and mapping of deep-sea biodiversity in the Azores on board the MT Physeter

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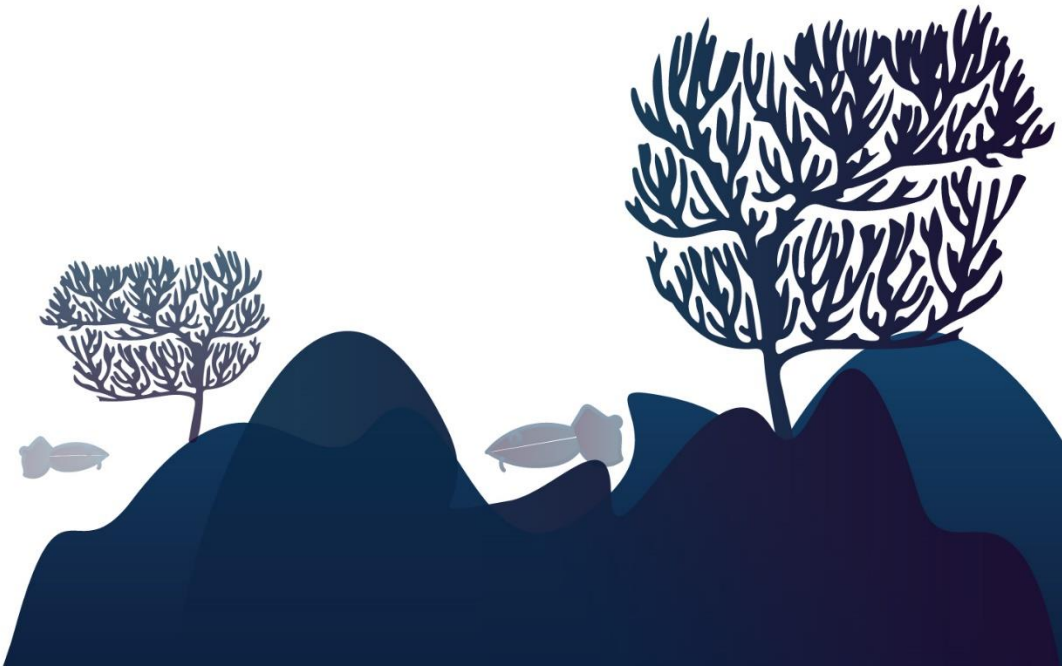

MAPGES 2023 CRUISE REPORT: EXPLORATION AND MAPPING OF DEEP-SEA BIODIVERSITY IN THE AZORES ON BOARD THE MT PHYSETER

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RESUMO EM PORTUGUÊS

O MapGES 2023 é a continuação da nossa estratégia de longo prazo para mapear a biodiversidade do mar profundo dos Açores e identificar áreas que se enquadrem nos critérios de Ecossistemas Marinhos Vulneráveis (VMEs) usando o sistema de imagens Azor drift-cam. Tal como noutros cruzeiros MapGES, os objetivos foram (i) mapear as comunidades bentónicas que habitam montes submarinos, cordilheiras e encostas insulares inexplorados, (ii) identificar novas áreas que se enquadrem na definição de Ecossistema Marinho Vulnerável da FAO, e (iii) determinar os padrões de distribuição da biodiversidade bentónica de profundidade nos Açores. Os resultados deste cruzeiro somaram-se aos anteriores para identificar os padrões ambientais que determinam a distribuição espacial da biodiversidade bentónica de profundidade nos Açores. Também fornece informações valiosas no contexto da avaliação do Bom Estado Ambiental (GES), do Ordenamento do Espaço Marinho (MSP) e a gestão sustentável dos ecossistemas do mar profundo.

A missão MapGES 2023 a bordo do MT Physeter foi composta por duas partes, divididas em 5 Legs. Na primeira parte, visitámos algumas áreas inexploradas como o Boureé NE (anteriormente Açor NW), banco Açor, de Guerne N (anteriormente Açor SE), São Mateus de Fora, Agulhas das 18 Milhas, monte submarino Álvaro Martins, Terceira N, Terceira S, Terceira E, Maçarico, Beirada de fora (anteriormente incluído em Maçarico) e Gastromar. Na segunda parte visitámos, também, algumas áreas inexploradas em torno da Ilhas de São Jorge, como São Jorge E Topo e São Jorge NE, e em torno da Ilha de São Miguel, como São Miguel N, NE, E, SE, S, SW, O, NO, e Mar da Prata Norte, e revistamos outras áreas São Jorge SE, e São Jorge S Urzelina.

Durante esta missão foram realizados **204 mergulhos** em 212 estações até cerca de 1 000 m de profundidade, cobrindo **124 km de fundo** do mar e produzindo mais de **211 horas de imagens** de vídeo. Estes mergulhos foram realizados em 32 áreas de amostragem, que incluíram 11 montes submarinos e 21 áreas na encosta das ilhas da Terceira, São Miguel e São Jorge. Nestas campanhas, efetuamos, pela primeira vez, um extenso levantamento científico sobre as comunidades bentónicas do mar profundo que habitam margens e encostas localizadas em torno da Ilha de São Miguel.

Esta campanha teve como principais destaques:

1. Conseguimos visitar trinta e duas unidades geomorfológicas inexploradas na ZEE dos Açores listadas na avaliação de áreas com substanciais lacunas de conhecimento
    a. Parte 1 (Legs 1, 2 e 3) - estruturas a sul do Faial e à volta das Ilhas do Pico - Boureé NE (Açor NW), Açor, de Guerne N (Açor SE), São Mateus de Fora, Agulhas 18 Milhas - e 6 novas áreas à volta da Terceira - Álvaro Martins, Terceira N, Terceira S, Terceira E, Maçarico, Gastromar, Beirada de fora. Também visitámos algumas áreas que já tinham sido exploradas anteriormente, mas que careciam

de dados de vídeo adicionais, nomeadamente a Terceira NE e o Pico N. Também visitámos uma área totalmente inexplorada até à data denominada Agulha das 12 Milhas.

b. Parte 2 (legs 4 e 5) – São Jorge E Topo, São Miguel N, NE, E, SE, S, SW, O, NO, e Mar da Prata Norte. Conseguimos colmatar algumas lacunas de conhecimento sobre as comunidades bentónicas localizadas nas porções sudeste e oriental da Ilha de São Jorge (São Jorge SE e S Urzelina), uma zona de difícil acesso e exploração em pequenas embarcações como o MT Physeter, que não tivemos a oportunidade de visitar em campanhas anteriores.

2. Durante a Leg 1 do cruzeiro MapGES 2023 MT Physeter explorámos zonas particularmente sensíveis devido à atividade de pesca, nomeadamente a sul das ilhas do Faial e do Pico. À semelhança dos anos anteriores, a presença de algumas linhas de pesca tornou desafiante a nossa exploração do mar profundo. Depois de ter a Azor drift-cam presa em várias linhas de pesca, conseguimos libertar apenas com pequenos danos. Este impacto colateral da pesca pode dificultar a aquisição de dados sobre a biodiversidade do mar profundo.
3. Tanto na Leg 1 como na Leg 2 da campanha MapGES 2023 MT Physeter, a maioria dos mergulhos realizados em fundos sedimentares, geralmente caracterizadas por baixos níveis de biodiversidade. No entanto, algumas extensas agregações dos corais primnóides *Narella versluysi* e *Narella bellissima* foram ocasionalmente observadas colonizando afloramentos rochosos. A esponja de ninho de pássaro *Pheronema carpenteri* juntamente com *Asconema fristedti* compuseram a maior parte das comunidades de esponjas, cobrindo áreas de substrato misto. No MapGES 2023 MT Physeter Leg2, um destaque particularmente surpreendente, já que não tinha sido registado antes, foi a impressionante agregação do equinodermo *Cidaris cidaris*. Abrangeu uma vasta secção do transeto sobre fundo sedimentar plano, sendo a maior e mais densa agregação que observada até agora na região dos Açores.
4. A abundância, diversidade e condição em que as várias comunidades bentónicas observadas se encontravam a prosperar nas encostas da ilha Terceira foi particularmente especial e definitivamente um ponto alto da Leg 3. Apesar dessas áreas anteriormente inexploradas estarem sujeitas a graus consideráveis de esforço de pesca, a maior parte da fauna bentónica observada parecia visualmente saudável, abrigando também muitas espécies de peixes associadas. Os principais destaques da Leg 3 foram o avistamento de colónias anormalmente grandes do coral *Dentomuricea* aff. *meteor* na Terceira N, possivelmente os maiores espécimens que já registamos na região dos Açores, a descoberta de áreas com agregações de coral negro como *Leiopathes glaberrima* e *L. expansa*, principalmente na área Terceira E, e a observação do que pensamos serem pequenos corais primnóides ainda por identificar em pelo menos dois montes submarinos diferentes na área da Terceira E.
5. Durante a Leg 4 deste cruzeiro, foi efetuada, pela primeira vez, um extenso levantamento científico concebido para explorar, mapear e descrever as comunidades bentónicas de mar profundo que habitam margens, cristas, montes submarinos e encostas localizadas em torno da Ilha de São Miguel.
6. Nas legs 4 e 5 do MapGES 2023 MT Physeter, apesar de um grande número de mergulhos terem sido realizados em fundos sedimentares e arenosos, geralmente caracterizados por baixos níveis de biodiversidade, houve locais que mostraram extensas agregações de corais que são indicativos de ecossistemas marinhos vulneráveis (VMEs). Estas agregações foram encontradas principalmente em profundidades inferiores a 400-500 m e foram dominadas por colónias extraordinariamente grandes de *Callogorgia verticillata* e, menos frequentemente, por colónias de *Dentomuricea* aff. *meteor*, frequentemente associadas com outras espécies de corais geralmente encontradas ao redor do arquipélago dos Açores, como *Viminella flagellum* e *Acanthogorgia* spp. Em poucas ocasiões, agregações

extensas dos corais primnóides *Narella versluysi* e *Narella bellissima* foram observadas, estes em profundidades superiores a 500 m.

7. Destaca-se a observação, ao redor da ilha de São Miguel, de algumas agregações de corais que parecem ser particularmente raras de observar no arquipélago dos Açores. Estes incluem (i) uma vasta área completamente coberta por um recife do coral duro *Eguchipsammia cornucopia*; (ii) um jardim de corais extraordinariamente denso que inclui, entre outras espécies, o coral *Paragorgia johnsoni* (uma espécie que não parece ser muito comum nas encostas das ilhas), e densidades particularmente elevadas das espécies primnóides *Narella bellissima* e *N. versluysi*; iii) uma vasta área dominada por uma espécie não identificada da família Stylasteridae (ou seja, corais rendilhados); and iv) uma área dominada por um raro coral arroxeado, possivelmente pertencente ao género *Paramuricea*.
8. No que diz respeito às agregações de esponjas, os destaques destas duas Legs vão para (i) a observação de extensas áreas com a presença de *Pseudotrachya hystrix*, principalmente nos fundos arenosos, (ii) o avistamento frequente de exemplares de grandes dimensões de *Characella pachastrelloides* complex, e (iii) a observação frequente de agregações grandes e disseminadas da chamada “Esponja ninho de pássaro", *Pheronema carpenteri*.
9. Uma possível nova espécie de peixe de profundidade poderá ter sido observada pela primeira vez no arquipélago dos Açores, denominada de *Gaidropsaurus* sp., e avistada em dois dias diferentes.
10. A alga invasora *Rugulopteryx okamurae*, que nos últimos anos tem tido uma presença cada vez mais frequente pela costa Açoreana, foi repetidamente observada em grandes manchas até profundidades de cerca de 900 m, sugerindo que o impacto desta espécie nas comunidades residentes pode não só limitar-se a zonas costeiras, mas também estender-se ao mar profundo dos Açores. Portanto, a fim de compreender completamente como *Rugulopteryx okamurae* altera a dinâmica de distribuição e nicho de espécies nativas e a extensão de seus impactos, há uma necessidade de investigar como esta afeta comunidades de baixa a alta profundidade.
11. Em geral, verificou-se que as comunidades bentónicas em redor da Ilha de São Miguel apresentam um aparente bom estado ambiental. Esta observação é particularmente relevante se considerarmos que esta área concentra uma parte significativa do esforço de pesca de fundo na Região dos Açores.
12. Durante a Leg2 deste cruzeiro, alcançamos um marco há muito esperado: capacitar os nossos parceiros do Atlântico Sul a operar o drift-cam Azor. O workshop de capacitação iAtlantic teve como objetivo partilhar os detalhes tecnológicos e metodológicos para a utilização da Azor drift-cam. Decorreu de 5 a 8 de junho de 2023 nas instalações da Escola do Mar (EMA) na cidade da Horta (Ilha do Faial, Portugal). Um total de 12 investigadores do consórcio iAtlantic provenientes do Brasil, África do Sul e Reino Unido participaram no workshop organizado pelo grupo Azores Deep-Sea Research. Todas as despesas foram cobertas pelo projeto iAtlantic. O workshop incluiu duas saídas de mar de meio dia a bordo do MT Physeter para mostrar aos participantes como operar a Azor drift-cam em condições reais.

SUMMARY IN ENGLISH

MapGES 2023 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 imagery system. 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 Vulnerable Marine Ecosystem definition; and (iii) determine distribution patterns of deep-sea benthic biodiversity in the Azores. The results of this cruise added

to the previous contributions to identify the environmental drivers that determine the spatial distribution of deep-sea benthic biodiversity in the Azores. It also provides valuable information in the context of Good Environmental Status (GES), Marine Spatial Planning (MSP) and new insights on how to sustainably manage deep-sea ecosystems.

The MapGES 2023 MT Physeter cruise was composed of two parts divided into 5 Legs. In the first part, we visited some unexplored areas such as the geomorphological structures Boureé NE (previously named Açor NW), Açor bank, de Guerne N (previously named Açor SE), São Mateus de Fora, Agulhas das 18 Milhas, Álvaro Martins seamount, Terceira N, Terceira S, Terceira E, Maçarico, Beirada de fora (previously part of Maçarico) and Gastromar. In the second, we also visited some unexplored areas such as the geomorphological structures around the islands of São Jorge (São Jorge E Topo e São Jorge NE) and of São Miguel (São Miguel N, NE, E, SE, S, SW, O, NO, e Mar da Prata Norte), and we revisited other geomorphological structures that needed complementary sampling efforts as, for example, São Jorge SE, e São Jorge S Urzelina.

During the MapGES 2023 MT Physter cruise, we performed 204 dives in 212 stations down to 1 000 m depth, and covered about 124 km of seafloor, resulting in more than 211 hours of video images. These dives were conducted in 32 different sampling areas, including 11 seamounts and 21 island slopes around the islands of Terceira, São Miguel, and São Jorge. During this cruise, we explored, for the first time, the deep-sea benthic communities inhabiting banks, ridges, seamounts, and slopes located around the Island of São Miguel.

This survey produced the following main achievements:

1. We visited thirty-two unexplored geomorphological structures in the Azores EEZ listed in the evaluation of areas with substantial knowledge gaps
    a. Part 1 (Legs 1, 2, and 3) –geomorphological structures south of Faial and around Pico Islands Boureé NE (Açor NW), Açor, de Guerne N (Açor SE), São Mateus de Fora, Agulhas 18 Milhas; and 6 new areas around Terceira - Álvaro Martins, Terceira N, Terceira S, Terceira E, Maçarico, Gastromar, Beirada de fora. We also visited some areas that have already been explored but needed extra video data, namely Terceira NE and Pico N. We also explored a completely new area named 12 Milhas.
    b. Part 2 (Legs 4 and 5) – São Jorge E Topo, São Miguel N, NE, E, SE, S, SW, O, NO, e Mar da Prata Norte. We managed to fill some knowledge gaps about the benthic communities located in the southeast and eastern portions of São Jorge Island (São Jorge SE and S Urzelina).
2. During the Leg 1 of the MapGES 2023 MT Physeter cruise, we explored particularly sensitive areas due to fishing activities, namely south of Faial and Pico islands. As in previous years, the presence of some 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. This collateral fishing impact is hampering the acquisition of deep-sea biodiversity data to inform management and deserve to be better quantified. Problems with the Outland laser systems resulted in the lack of laser points in some of the images recorded.
3. In both Leg 1 and Leg 2 of MapGES 2023 Physeter cruise, most of the dives performed covered sections of sedimentary bottoms, usually characterized by low levels of biodiversity. Nevertheless, some extensive aggregations of the primnoid corals *Narella versluysi* and *Narella bellissima* were occasionally observed colonizing rocky outcrops. The bird's nest sponge *Pheronema carpenteri,* together with *Asconema fristedti* composed most of the sponge assemblage, covering areas of mixed substrate. In MapGES 2023 Physeter cruise Leg2, a particularly surprising highlight, since we were completely unaware of this throughout the

dive itself, was the impressive aggregation of the echinoderm *Cidaris cidaris*. It covered a vast section of flat sedimentary seafloor, being the largest and densest aggregation we have recorded so far in the Azores region.

4. The abundance, diversity, and condition in which the several benthic communities observed were found thriving on the Terceira island's slopes was particularly special and definitely a highlight of Leg 3. Despite these previously unexplored areas being subjected to considerable degrees of fishing effort, most of the benthic fauna observed was visually healthy and harboured many associated fish species as well. The main highlights of Leg 3 were: (1) the sighting of uncommonly large specimens of the coral *Dentomuricea* aff. *meteor* in Terceira N, quite possibly the largest specimens we have recorded so far in the Azores region; (2) The detection of areas with the display of black coral aggregations such as *Leiopathes glaberrima* and *L. expansa*; (3) Observation of what we believe to be small primnoid corals yet to be identified in at least two different seamounts in Terceira E area.
5. During Leg 4, it was the first time an extensive scientific survey was specifically designed to map and describe deep-sea benthic communities inhabiting banks, ridges, seamounts, and slopes located around the Island of São Miguel.
6. In both Legs 4 and 5 of MapGES 2023, most of the dives performed covered sections of sedimentary bottoms, usually characterized by low levels of biodiversity. Nevertheless, there were locations showing extensive coral aggregations that potentially are indicative of Vulnerable Marine Ecosystems. These aggregations were mostly encountered at depths shallower than 400-500 m depth and were dominated by extraordinarily large colonies of *Callogorgia verticillata* and, less frequently, by colonies of *Dentomuricea* aff. *meteor* often associated with other coral species commonly found around the Azores, such as *Viminella flagellum* and *Acanthogorgia* spp. On a few occasions, extensive aggregations of the primnoid corals *Narella versluysi* and *Narella bellissima* were observed at depths greater than 500 m.
7. Also noteworthy is the observation, during Leg 5, of some coral aggregations that appear to be particularly rare in the archipelago of the Azores. These include (i) a vast area completely covered by a reef of the stony coral *Eguchipsammia cornucopia*; (ii) an extraordinarily dense coral garden featuring, among other species, the bubble gum coral *Paragorgia johnsoni* (a species that do not appear to be very common on island slopes), and particularly high densities of the primnoid species *Narella bellissima* and *N. versluysi*; (iii) a large area dominated by an unidentified species of the family Stylasteridae (i.e. lace corals); (iv) an area dominated by a rare purple coral most likely of the genus *Paramuricea*; (v) an aggregation of black corals (order Antipatharia) on the northern part of Mar da Prata Bank.
8. Regarding sponge aggregations, the highlights of these two legs are (i) the observation of extensive areas with the presence of the species *Pseudotrachya hystrix*, mainly encountered at the common sandy floors where we usually drifted over, (ii) some frequent sightings of even bigger specimens of the often-robust *Characella pachastrelloides* complex and, (iii) the frequent notice of big and widespread aggregations of the "bird nest" sponge, *Pheronema carpenteri*.
9. A potential new species of deep-sea fish may have been observed for the first time in the Azores archipelago, named *Gaidropsaurus* spp., spotted on two different days.
10. The invasive algae *Rugulopteryx okamurae*, which in recent years appeared on most Azorean shores, was very frequently observed in large patches down to depths of about 900 m, suggesting that the impact of this species on resident communities may not only be limited to coastal areas but also extend into the deep sea of the Azores. Therefore, to fully understand how *Rugulopteryx okamurae* alters the distributional and

niche dynamics of native species and the extent of its impacts, there is a need to investigate how it affects both shallow and deep-sea communities.

11. In general, it was found that the benthic communities around São Miguel Island present an apparent good environmental status. This observation is particularly relevant if we consider that this area concentrates a significant part of the bottom fishing effort in the Azores Region.
12. During Leg2 of this cruise, we achieved a long waiting milestone: teaching our South Atlantic partners how to operate the Azor drift-cam. The iAtlantic capacity building workshop aimed to share the technological and methodological details for the use of the Azor drift-cam. It ran from 5-8th June 2023 in the facilities of Escola do Mar (EMA) in the city of Horta (Faial Island, Portugal). A total of 12 researchers from the iAtlantic consortium coming from Brazil, South Africa and the United Kingdom took part in the workshop organized by the Azores Deep-Sea Research group. The workshop included two half-a-day surveys on board MT Physeter to show the participants how to deploy the Azor drift-cam in real conditions and how to operate the system to effectively collect video footage of deep-sea benthic habitats. We also had the opportunity of having the Rolex filming crew as well as Pepe Brix onboard, which were interested in taking some images of this capacity building event.

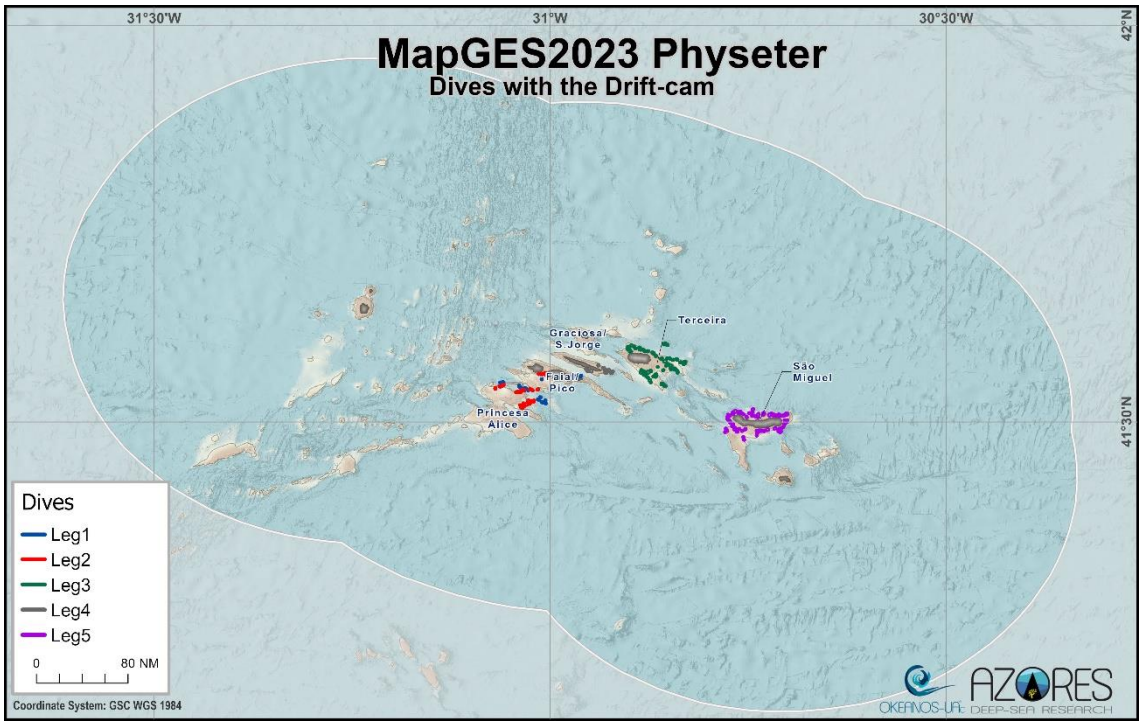

Figure 1. Location of the 212 stations carried out with the Azor drift-cam during the MapGES 2023 MT Physeter field activities.

Figure 2. Screenshots taken from the footage recorded during the MapGES 2023 MT Physeter field activities.

1 MAPGES 2023 MT PHYSETER: EXPLORATION AND MAPPING OF DEEP-SEA BIODIVERSITY IN THE AZORES Legs 1, 2 and 3 - Princesa Alice Bank and Slopes of Terceira Island.

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Date: 31 de julho 2023

1.1 RESUMO EM PORTUGUÊS

O MapGES 2023 é a continuação da nossa estratégia de longo prazo para mapear a biodiversidade do mar profundo dos Açores e identificar áreas que se enquadrem nos critérios de Ecossistemas Marinhos Vulneráveis (VMEs) usando o sistema de imagens Azor drift-cam. Neste cruzeiro, operamos a partir da embarcação Maritimo Turistica Physeter e visitamos algumas áreas inexploradas como o Boureé NE (anteriormente Açor NW), banco Açor, de Guerne N (anteriormente Açor SE), São Mateus de Fora, Agulhas das 18 Milhas, monte submarino Álvaro Martins, Terceira N, Terceira S, Terceira E, Maçarico, Beirada de fora (anteriormente incluído em Maçarico) e Gastromar. Tal como noutros cruzeiros MapGES, os objectivos foram (i) mapear as comunidades bentónicas que habitam montes submarinos, cordilheiras e encostas insulares inexplorados, (ii) identificar novas áreas que se enquadrem na definição de Ecossistema Marinho Vulnerável da FAO, e (iii) determinar os padrões de distribuição da biodiversidade bentónica de profundidade nos Açores. Os resultados deste cruzeiro somaram-se aos anteriores para identificar os drivers ambientais que determinam a distribuição espacial da biodiversidade bentónica de profundidade nos Açores. Ele também fornece informações valiosas no contexto do Bom Estado Ambiental (GES), Ordenamento do Espaço Marinho (MSP) e novos dados que ajudem à gestão sustentável dos ecossistemas do mar profundo.

A parte 1 da campanha a bordo do MT Physeter foi composta por três partes, que foram planeadas para visitar algumas áreas de bancos e montes submarinos a sul das ilhas do Faial e do Pico (p. ex., Princesa Alice, banco Açor, Agulhas, entre outras) e à volta da Ilha Terceira (Figura 30, Tabela 1). Ao todo, foram realizados 115 mergulhos, de entre 119 estações, em 13 áreas de amostragem distintas, percorrendo cerca de 68.6 km de fundo e produzindo 119:55 horas de imagens de vídeo (Tabela 1). Durante a Leg 1, que decorreu de 15 a 21 de maio de 2023, realizámos 27 mergulhos bem-sucedidos com a Azor drift-cam, onde exploramos as comunidades bentónicas de profundidade que habitam as encostas das estruturas geomorfológicas do banco Princesa Alice, São Mateus de fora, Agulhas das 18 Milhas e Banco Boureé. Durante a Leg 2, de 30 de maio a 11 de julho de 2023, realizamos 25 mergulhos bem-sucedidos. A leg 2 da campanha MapGES 2023 Physeter continuou a explorar as encostas a sul do Faial e da Ilha do Pico, como De Guerne N, Bourée, Açor e o Agulhas das 12 Milhas. Ainda na Leg 2, foram realizados 4 mergulhos no canal Faial-Pico no âmbito do workshop sobre a Azor drift-cam. Durante a Leg 3 da campanha a bordo do MT Physeter, que se realizou de 14 a 30 de julho de 2023, explorámos as encostas ao redor da Ilha Terceira, incluindo as estruturas Gastromar e Maçarico e o monte submarino Álvaro Martins.

Esta campanha teve diversos destaques principais:

1. Conseguimos visitar onze estruturas geomorfológicas inexploradas na ZEE dos Açores listadas na Secção 8 do R1 “Avaliação de áreas com suficiente informação pré-existente e com substanciais lacunas de conhecimento”. Estas áreas incluem estruturas a sul do Faial e à volta das Ilhas do Pico - Boureé NE

(Açor NW), Açor, de Guerne N (Açor SE), São Mateus de Fora, Agulhas 18 Milhas - e 6 novas áreas à volta da Terceira - Álvaro Martins, Terceira N, Terceira S, Terceira E, Maçarico, Gastromar, Beirada de fora. Também visitámos algumas áreas que já tinham sido exploradas anteriormente, mas que careciam de dados de vídeo adicionais, nomeadamente a Terceira NE e o Pico N. Também explorámos uma área completamente nova denominada Agulha das 12 Milhas.

2. Durante o cruzeiro MapGES 2023 MT Physeter Leg1, Leg2 e Leg3, realizamos 119 transetos de vídeo subaquáticos com a câmara de deriva Azor drift-cam, totalizando 119:55 horas de novas imagens de vídeo subaquático dos habitats do mar profundo dos Açores. Esta foi uma grande conquista, considerando que operamos novamente a Azor drift-cam a bordo de uma embarcação pequena.
3. Durante a Leg 1 do cruzeiro MapGES 2023 Physeter explorámos zonas particularmente sensíveis devido à atividade de pesca, nomeadamente a sul das ilhas do Faial e do Pico. À semelhança dos anos anteriores, a presença de algumas linhas de pesca tornou desafiante a nossa exploração do mar profundo. Depois de ter a Azor drift-cam presa em várias linhas de pesca, conseguimos libertar apenas com pequenos danos. Este impacto colateral da pesca pode dificultar a aquisição de dados sobre a biodiversidade do mar profundo.
4. Tanto na Leg 1 como na Leg 2 da campanha MapGES 2023 Physeter, a maioria dos mergulhos realizados em fundos sedimentares, geralmente caracterizadas por baixos níveis de biodiversidade. No entanto, algumas extensas agregações dos corais primnóides *Narella versluysi* e *Narella bellissima* foram ocasionalmente observadas colonizando afloramentos rochosos. A esponja de ninho de pássaro *Pheronema carpenteri* juntamente com *Asconema fristedti* compuseram a maior parte das comunidades de esponjas, cobrindo áreas de substrato misto. No MapGES 2023 Physeter Leg2, um destaque particularmente surpreendente, já que não tinha sido registado antes, foi a impressionante agregação do equinodermo *Cidaris cidaris*. Abrangeu uma vasta secção do transeto sobre fundo sedimentar plano, sendo a maior e mais densa agregação que observada até agora na região dos Açores.
5. A abundância, diversidade e condição em que as várias comunidades bentónicas observadas se encontravam a prosperar nas encostas da ilha Terceira foi particularmente especial e definitivamente um ponto alto da Leg 3. Apesar dessas áreas anteriormente inexploradas estarem sujeitas a graus consideráveis de esforço de pesca, a maior parte da fauna bentónica observada parecia visualmente saudável e também abrigava muitas espécies de peixes associadas. Os principais destaques da Leg 3 foram o avistamento de espécimes incomumente grandes do coral *Dentomuricea* aff. *meteor* na Terceira N, possivelmente os maiores espécimens que já registamos na região dos Açores, a descoberta de áreas com agregações de coral negro como *Leiopathes glaberrima* e *L. expansa*, principalmente na área Terceira E, e a observação do que pensamos serem pequenos corais primnóides ainda por identificar em pelo menos dois montes submarinos diferentes na área da Terceira E.
6. Durante a Leg2 deste cruzeiro, alcançamos um marco há muito esperado: capacitar os nossos parceiros do Atlântico Sul a operar o drift-cam Azor. O workshop de capacitação iAtlantic teve como objetivo partilhar os detalhes tecnológicos e metodológicos para a utilização da Azor drift-cam. Decorreu de 5 a 8 de junho de 2023 nas instalações da Escola do Mar (EMA) na cidade da Horta (Ilha do Faial, Portugal). Um total de 12 investigadores do consórcio iAtlantic provenientes do Brasil, África do Sul e Reino Unido participaram no workshop organizado pelo grupo Azores Deep-Sea Research. Todas as despesas foram cobertas pelo projeto iAtlantic. O workshop incluiu duas saídas de mar de meio dia a bordo do MT Physeter para mostrar aos participantes como operar a Azor drift-cam em condições reais.

1.2 SUMMARY OF THE MAPGES 2023 MT PHYSETER CRUISE PART 1

1.2.1 Main objectives

MapGES 2023 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 imagery system. On this cruise, we operated from the MT Physeter and planned to visit some unexplored areas, such as the geomorphological structures around the Princesa Alice bank and the slopes of Terceira Island (central 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 Vulnerable Marine Ecosystem definition, and (iii) determine distribution patterns of deep-sea benthic biodiversity in the Azores. The results of this cruise added to the previous contributions to identify the environmental drivers that determine the spatial distribution of deep-sea benthic biodiversity in the Azores. It also provides valuable information in the context of Good Environmental Status (GES), Marine Spatial Planning (MSP) and new insights on how to sustainably manage deep-sea ecosystems.

1.2.2 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 MT Physeter. In each of the areas or geomorphological structures to be explored, a representative number of dives (or transects) were carried out with a video camera system from a depth of about 1 000 m to the shallowest depth of each structure. The objective is to obtain underwater images to characterize the biodiversity along the entire bathymetric gradient and substrate types of each structure. The video transects were planned according to the best bathymetry available, so that the camera systems move from deeper to shallower areas. This methodology allows the collected images to always have the best possible quality, maximizing the area of incidence of light and avoiding its dissipation in the water column (in the case of descending transects). The transects carried out with the Azor drift-cam were planned to last approximately 60 min in the seafloor, with the system drifting over the benthic habitats at an approximate speed of 0.5 to 1 knots. Under normal oceanographic conditions, each working day allowed for 5 to 6 dives, corresponding to around 5 km of bottom explored per day.

Vessel

MT Physeter

Dates

Leg 1: 15th to 21st May

Leg 2: 30th May to 11th June

Leg 3: 14th to 30th July

1.2.3 Scientific team

Scientific team in Leg 1: Telmo Morato, Carlos Dominguez-Carrió (chief scientists), Luís Rodrigues, Guilherme Gonçalves, Inês Carneiro, Manuela Ramos, João Balsa, Marc Pladevall, Laurence Fauconnet, Inês Bruno, Gal·la Edery.

Scientific team in Leg 2: Telmo Morato, Carlos Dominguez-Carrió (chief scientists), Luís Rodrigues, Guilherme Gonçalves, Inês Carneiro, João Balsa, Marc Pladevall, Laurence Fauconnet, Sérgio Gomes.

Scientific team in Leg 3: Telmo Morato, Luís Rodrigues, (chief scientists), Isabel Areosa, João Balsa, Inês Bruno, Inês Carneiro, Sérgio Gomes, Guilherme Gonçalves, and Gerald Taranto.

1.2.4 Statistics

During the MapGES 2023 cruise onboard the MT Physeter, we performed a total of 119 dives, covering about 68.6 k of the seafloor and producing 119:55 hours of video footage (Table 1).

Leg 1: We performed 27 dives with the Azor drift-cam down to 960 m depth, covering 15.9 km of the seafloor and producing 27:26 hours of video footage.

Leg 2: We performed 25 dives with the Azor drift-cam down to 963 m depth, covering 14 km of the seafloor and producing 20:58 hours of video footage.

Leg 3: We performed 67 dives with the Azor drift-cam down to 1000 m depth, covering 38 km of the seafloor and producing 71 hours of video footage.

1.2.5 Cruise summary

The first part of the MapGES 2023 MT Physeter survey was composed of three Legs, which were planned to visit some areas of banks and seamounts south of Faial and Pico islands (e.g., Princesa Alice, Açor, Agulhas, among others) and around Terceira Island, onboard MT Physeter (Figure 30, Table 1). Overall, 115 dives out of 119 stations were accomplished in 13 sampling areas. During **Leg 1**, from 15th to 21st May 2023, we performed 27 successful dives with the Azor drift-cam, where we surveyed the deep-sea benthic communities dwelling on the slopes of the geomorphological structures of Princesa Alice, São Mateus de fora, Agulhas and Bourée banks. During the **Leg 2**, from 30th May to 11th July 2023, we performed 25 successful dives with the Azor drift-cam. Leg 2 of the MapGES 2023 cruise continued exploring slopes south Faial and Pico Island, such as De Guerne N, Bourée and Açor. Also, during Leg 2, 4 dives were carried out in the Faial-Pico channel as part of the workshop Azor drift-cam and an unexplored area called Agulhas 12 Milhas was visited. During **Leg 3**, from 14thJuly to 30thJuly 2023, we resurveyed and explored some new seamounts and slopes around Terceira Island, including Gastromar, Maçarico or Álvaro Martins structures, accounting for a total of 67 dives.

Table 1. Areas surveyed during each of the Legs of part 1 of the MapGES 2023 MT Physeter cruise, with information on the amount of underwater terrain explored and time of filming accomplished.

Leg	Dates	Areas explored	Dives (n)	Dist. (m)	Bottom time (h)
1	15/05/2023-21/05/2023	Banks south of Faial and Pico Islands slopes: Faial S, São Mateus de Fora, Boureé NE, Pico NE	27	15,920	27:26
2	30/05/2023-11/06/2023	Banks south of Faial: De Guerne N, Boureé NE, Agulhas 12 Milhas, Agulhas 18 Milhas, and Açor bank	25	14,410	20:58
3	14/07/2023-30/07/2023	Terceira Island slopes: Terceira N, NE, E and S, Gastromar, Maçarico, and Álvaro Martins seamount	67	38,260	71:31
		Total	**119**	**68,590**	**119:55**

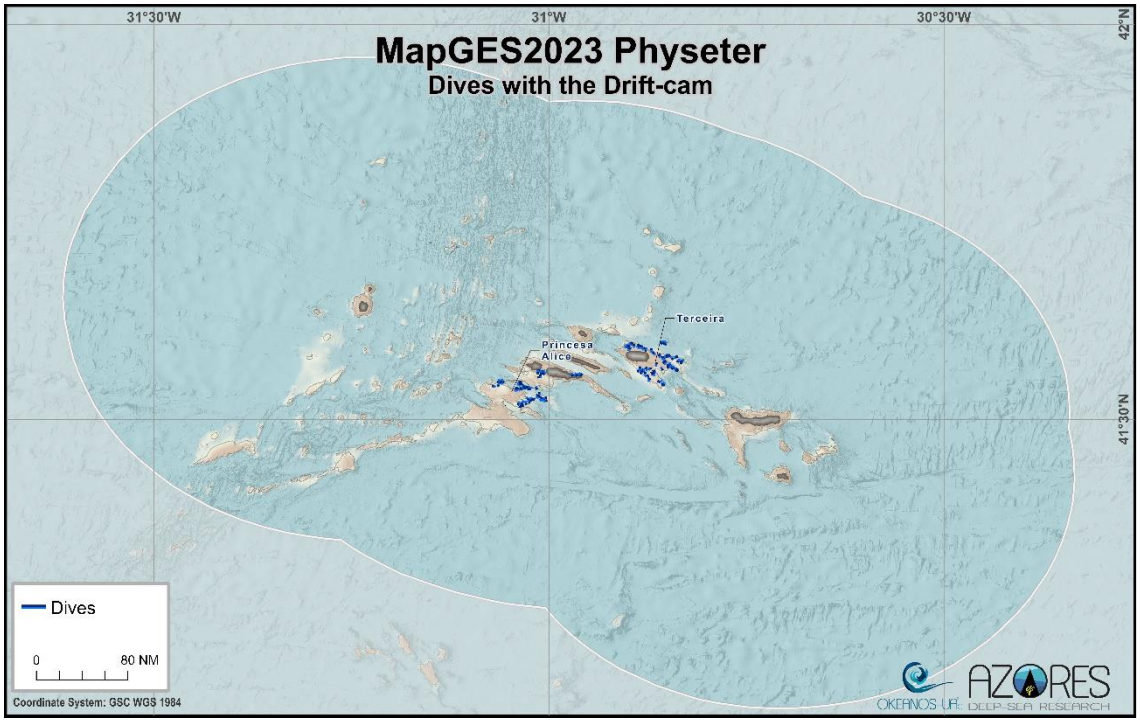

Figure 3. Location of the 114 dives performed with the Azor drift-cam in seamounts and island slopes around the eastern and central groups during the 3 legs of part 1 of MapGES 2023 MT Physeter.

Figure 4. Screenshots taken from the footage recorded during Leg 1, 2 and 3 of MapGES 2023 cruise onboard the MT Physeter. (a) Narella versluysi and Narella bellisima garden; (b) Aggregation of cf. Candidella imbricata and Narella versluysi; (c) Dense coral garden dominated by *Narella versluysi;* (d)Aggregation of the glass sponge *Pheronema carpenter;* (e) Extensive and highly abundant patch of the echinoderm *Cidaris cidaris.* (f) Large colonies of *Dentomuricea aff. meteor*. (g) High abundance of what we believe are small primnoid corals, yet to be identified. (e) *Haliclona magna* curiously used as a refuge by a conger eel (*Conger conger*)

1.2.6 Main achievements

1. Were able to visit 5 unexplored geomorphological structures in south of Faial and around Pico Islands Boureé NE (Açor NW), Açor, de Guerne N (Açor SE), São Mateus de Fora, Agulhas 18 Milhas; and 6 new areas around Terceira - Álvaro Martins, Terceira N, Terceira S, Terceira E, Maçarico, Gastromar, Beirada de for a. We also visited some areas that have already been explored but needed extra video data, namely Terceira NE and Pico N. We also explored a completely new area named 12 Milhas.
2. During the MapGES 2023 Physeter cruise Leg1, Leg2 and Leg3 we accomplished 119 underwater video transects with the Azor drift-cam, adding up to around 119:55 hours of new underwater video footage of

seabed habitats. This was a big achievement considering that we successfully operated, once again, the Azor drift-cam for deep-sea exploration onboard a small vessel.

3. During Leg 1 MapGES 2023 Physeter cruise we explored particularly sensitive areas due to fishing activities, namely south of Faial and Pico islands. As in previous years, the presence of some fishing lines made our deep-sea exploration challenging. After having the Azor drift-cam caught on several fishing lines, we managed to get free with only minor damages. This collateral fishing impact is preventing the acquisition of deep-sea biodiversity data to inform management and deserves to be better quantified. Problems with the Outland laser systems resulted in the lack of laser points in some of the images recorded.
4. In both Leg1 and Leg 2 of MapGES 2023 Physeter cruise, most of the dives performed covered sections of sedimentary bottoms, usually characterized by low levels of biodiversity. Nevertheless, some extensive aggregations of the primnoid corals *Narella versluysi* and *Narella bellissima* were occasionally observed colonizing rocky outcrops. The bird's nest sponge *Pheronema carpenteri,* together with *Asconema fristedti* composed most of the sponge assemblage, covering areas of mixed substrate. In MapGES 2023 Physeter cruise Leg2, a particularly surprising highlight, since we were completely unaware of this throughout the dive itself, was the impressive aggregation of the echinoderm *Cidaris cidaris*. It covered a vast section of flat sedimentary seafloor, being the largest and densest aggregation we have recorded so far in the Azores region.
5. During Leg2 of this cruise, we achieved a long waiting milestone: teaching our South Atlantic partners how to operate the Azor drift-cam. The iAtlantic capacity building workshop aimed to share the technological and methodological details for the use of the Azor drift-cam. It ran from 5-8th June 2023 in the facilities of Escola do Mar (EMA) in the city of Horta (Faial Island, Portugal). A total of 12 researchers from the iAtlantic consortium coming from Brazil, South Africa and the United Kingdom took part in the workshop organized by the Azores Deep-Sea Research group. All the expenses were covered by the iAtlantic project. The workshop included two half-a-day surveys on board MT Physeter to show the participants how to deploy the Azor drift-cam in real conditions and how to operate the system to effectively collect video footage of deep-sea benthic habitats. We also had the opportunity of having the Rolex filming crew as well as Pepe Brix onboard, which were interested in taking some images of this capacity building event.
6. The abundance, diversity, and condition in which the several benthic communities observed were found thriving on the Terceira island's slopes was particularly special and definitely a highlight of Leg3. Despite these previously unexplored areas being subjected to considerable degrees of fishing effort, most of the benthic fauna observed was visually healthy and harboured many associated fish species as well. The main highlights of Leg 3 were: (1) the sighting of uncommonly large specimens of the coral *Dentomuricea* aff. *meteor* in Terceira N, quite possibly the largest specimens we have recorded so far in the Azores region; (2) The detection of areas with the display of black coral aggregations such as *Leiopathes glaberrima* and *L. expansa*; (3) Observation of what we believe are small primnoid corals yet to be identified in at least two different seamounts in Terceira E area.

1.3 STATIONS SURVEYED DURING MAPGES 2023 CRUISE ONBOARD THE MT PHYSETER PART 1

During the first part of the MapGES 2023 cruise onboard the MT Physeter, we performed a total of 115 dives out of 119 stations in 14 sampling areas. Here, we present a compilation of all the stations surveyed during this cruise (Table 2).

Table 2. Compilation of the stations surveyed during part 1 of the MapGES 2023 MT Physeter.

			Time		Start position		End position		Depth		Dist.
St	Location	Date	Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)	Start	End	(m)
St001	Faial S	15/05/2023	11:05	13:05	38.492	-28.646	38.494	-28.643	600	460	320
St002	Faial S	15/05/2023	14:05	16:08	38.417	-28.628	38.418	-28.624	730	643	330
St003	Faial S	15/05/2023	16:24	17:55	38.418	-28.623	38.42	-28.624	569	570	210
St004	S. Mateus de Fora	16/05/2023	10:37	11:58	38.157	-28.649	38.157	-28.641	815	778	680
St005	S. Mateus de Fora	16/05/2023	12:46	14:29	38.126	-28.68	38.124	-28.674	832	632	540
St006	S. Mateus de Fora	16/05/2023	14:48	16:04	38.122	-28.671	38.118	-28.667	541	430	550
St007	S. Mateus de Fora	16/05/2023	16:23	17:35	38.121	-28.667	38.118	-28.663	439	430	480
St008	S. Mateus de Fora	17/05/2023	10:17	12:22	38.091	-28.627	38.085	-28.618	926	628	1030
St009	S. Mateus de Fora	17/05/2023	12:38	13:15	38.087	-28.623	38.085	-28.621	527	643	230
St010	S. Mateus de Fora	17/05/2023	13:30	14:52	38.089	-28.606	38.085	-28.602	773	679	560
St011	S. Mateus de Fora	17/05/2023	15:09	16:15	38.072	-28.568	38.069	-28.566	796	670	370
St012	S. Mateus de Fora	17/05/2023	16:39	18:11	38.113	-28.574	38.109	-28.572	931	930	470
St013	18 Milhas	18/05/2023	11:10	12:39	38.324	-28.923	38.323	-28.918	811	766	470
St014	18 Milhas	18/05/2023	13:00	14:51	38.307	-28.944	38.303	-28.936	810	641	790
St015	18 Milhas	18/05/2023	15:08	16:23	38.31	-28.926	38.304	-28.921	599	515	790
St016	18 Milhas	18/05/2023	16:52	18:19	38.329	-28.953	38.325	-28.954	956	958	500
St017	Boureé NE	19/05/2023	10:21	12:22	38.37	-29.18	38.368	-29.183	915	775	310
St018	Boureé NE	19/05/2023	13:03	14:34	38.376	-29.187	38.378	-29.189	815	812	280
St019	Boureé NE	19/05/2023	15:01	16:26	38.369	-29.225	38.372	-29.228	644	699	430
St020	Boureé NE	19/05/2023	16:56	18:33	38.359	-29.19	38.361	-29.196	743	730	610
St021	Pico NE	20/05/2023	11:53	13:23	38.463	-28.073	38.455	-28.078	664	122	1010
St022	Pico NE	20/05/2023	13:53	15:51	38.47	-28.052	38.463	-28.059	950	792	950
St023	Pico NE	20/05/2023	16:16	17:45	38.469	-28.113	38.462	-28.121	734	227	1070
St024	Pico NE	20/05/2023	18:18	18:51	38.471	-28.169	38.47	-28.174	358	298	410
St025	18 Milhas	21/05/2023	9:45	11:06	38.292	-28.866	38.292	-28.877	478	422	950
St026	18 Milhas	21/05/2023	11:21	13:01	38.289	-28.853	38.285	-28.858	490	430	600
St027	18 Milhas	21/05/2023	13:32	15:56	38.266	-28.814	38.258	-28.82	811	620	980
St028	De Guerne N	30/05/2023	11:11	12:35	38.11	-28.744	38.102	-28.746	875	815	870
St029	De Guerne N	30/05/2023	13:04	14:09	38.11	-28.768	38.105	-28.771	915	803	550
St030	De Guerne N	30/05/2023	16:44	18:49	38.109	-28.775	38.103	-28.785	953	963	1120
St031	De Guerne N	31/05/2023	09:51	11:34	38.119	-28.822	38.116	-28.824	826	721	450
St032	De Guerne N	31/05/2023	12:00	13:10	38.07	-28.801	38.07	-28.802	750	575	140
St033	De Guerne N	31/05/2023	15:27	16:43	38.059	-28.842	38.055	-28.845	811	688	530
St034	De Guerne N	01/06/2023	11:17	12:28	38.043	-28.928	38.048	-28.933	639	756	680
St035	De Guerne N	01/06/2023	12:59	14:41	38.009	-28.904	38.011	-28.917	836	646	1110
St036	De Guerne N	01/06/2023	15:04	16:11	38.03	-28.885	38.031	-28.892	697	750	630
St037	De Guerne N	01/06/2023	16:26	17:40	38.058	-28.876	38.06	-28.882	892	895	560
St038	Boureé NE	03/06/2023	11:08	13:03	38.325	-29.188	38.329	-29.184	807	736	530
St039	Boureé NE	03/06/2023	13:42	15:13	38.293	-29.294	38.287	-29.292	862	850	690
St040	Boureé NE	03/06/2023	16:30	17:51	38.319	-29.227	38.32	-29.23	712	695	270
St041	Agulhas 18 Milhas	04/06/2023	10:03	12:35	38.272	-28.787	38.276	-28.788	918	722	430
St042	Agulhas 12 Milhas	04/06/2023	12:55	14:43	38.264	-28.753	38.267	-28.756	842	832	380
St043	Agulhas 12 Milhas	04/06/2023	15:10	16:50	38.277	-28.683	38.278	-28.689	929	916	480
St044	Faial-Pico S	05/06/2023	12:58	13:51							
St045	Faial-Pico S	05/06/2023	14:40	15:49							
St046	Faial-Pico S	08/06/2023	10:50	11:15	38.503	-28.659	38.505	-28.665	171	237	610
St047	Faial-Pico S	08/06/2023	11:39	12:43	38.498	-28.619	38.498	-28.62	290	246	50
St048	Açor	10/06/2023	10:03	10:04							
St049	Açor	10/06/2023	10:27	11:59	38.259	-28.892	38.252	-28.884	700	718	990
St050	Açor	10/06/2023	12:43	14:47	38.244	-28.939	38.235	-28.933		351	1180
St051	Açor	11/06/2023	10:05	11:59	38.233	-28.973	38.227	-28.961	555	303	1240

			Time		Start position		End position		Depth		Dist.
St	Location	Date	Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)	Start	End	(m)
St052	Açor	11/06/2023	12:17	13:35	38.225	-28.993	38.221	-28.984	475	324	920
St053	Terceira N	15/07/2023	09:45	11:00	38.874	-27.211	38.871	-27.21	820	650	340
St054	Terceira N	15/07/2023	11:27	12:53	38.872	-27.205	38.871	-27.205	730	610	150
St055	Terceira N	15/07/2023	13:16	14:05	38.866	-27.218	38.865	-27.217	428	490	120
St056	Terceira N	15/07/2023	14:53	16:31	38.887	-27.294	38.887	-27.285	312	321	770
St057	Terceira N	15/07/2023	16:45	18:36	38.905	-27.327	38.901	-27.315	513	498	1120
St058	Terceira N	16/07/2023	10:24	12:06	38.816	-27.341	38.814	-27.331	399	247	890
St059	Terceira N	16/07/2023	12:35	13:31	38.85	-27.358	38.846	-27.354	489	369	520
St060	Terceira N	16/07/2023	14:04	15:47	38.857	-27.388	38.853	-27.385	909	726	510
St061	Terceira N	16/07/2023	16:12	17:00	38.888	-27.378	38.886	-27.379	727	727	260
St062	Terceira N	16/07/2023	17:18	18:39	38.887	-27.371	38.878	-27.375	654	605	970
St063	Terceira NE & N	17/07/2023	09:08	10:44	38.831	-27.085	38.832	-27.086	974	976	140
St064	Terceira NE & N	17/07/2023	11:07	12:04	38.826	-27.136	38.824	-27.135	432	333	240
St065	Terceira NE & N	17/07/2023	12:23	14:01	38.839	-27.154	38.838	-27.15	631	489	350
St066	Terceira NE & N	17/07/2023	14:17	15:19	38.846	-27.162	38.846	-27.161	645	664	70
St067	Terceira NE & N	17/07/2023	15:39	17:06	38.844	-27.199	38.842	-27.191	250	195	800
St068	Terceira NE & N	17/07/2023	17:29	19:04	38.858	-27.268	38.859	-27.261	290	200	660
St069	Terceira E	18/07/2023	09:27	10:54	38.623	-26.741	38.621	-26.752	434	339	950
St070	Terceira E	18/07/2023	11:15	12:44	38.573	-26.744	38.582	-26.744	678	440	970
St071	Terceira E	18/07/2023	13:01	14:43	38.558	-26.743	38.566	-26.74	945	798	1020
St072	Terceira E	18/07/2023	15:09	16:57	38.611	-26.815	38.616	-26.811	480	372	590
St073	Terceira E	18/07/2023	17:09	18:24	38.631	-26.793	38.632	-26.79	430	355	250
St074	Terceira S	19/07/2023	10:21	11:35	38.556	-27.17	38.56	-27.179	456	261	910
St075	Terceira S	19/07/2023	12:03	13:46	38.518	-27.182	38.525	-27.187	877	735	920
St076	Terceira S	19/07/2023	14:11	16:09	38.491	-27.139	38.495	-27.142	838	550	500
St077	Terceira S	19/07/2023	16:27	18:11	38.522	-27.128	38.526	-27.13	638	545	450
St078	Terceira S	19/07/2023	18:20	19:40	38.53	-27.12	38.532	-27.125	464	354	450
St079	Maçarico	20/07/2023	09:52	11:12	38.643	-26.562	38.644	-26.564	865	875	190
St080	Maçarico	20/07/2023	12:11	13:53	38.655	-26.558	38.658	-26.562	609	628	520
St081	Maçarico	20/07/2023	14:14	15:31	38.669	-26.544	38.669	-26.546	850	801	180
St082	Maçarico	20/07/2023	15:47	17:03	38.669	-26.59	38.672	-26.601	410	405	960
St083	Maçarico	20/07/2023	17:15	17:40	38.669	-26.615	38.669	-26.615	585	585	50
St084	Álvaro Martins	21/07/2023	09:32	11:36	38.932	-26.836	38.938	-26.84	856	758	800
St085	Álvaro Martins	21/07/2023	11:50	14:03	38.93	-26.846	38.93	-26.857	954	891	900
St086	Álvaro Martins	21/07/2023	14:29	16:46	38.922	-26.797	38.929	-26.812	1000	710	1490
St087	Álvaro Martins	21/07/2023	17:23	18:59	38.933	-26.812	38.935	-26.821	840	677	760
St088	Gastromar	22/07/2023	10:54	12:38	38.33	-26.842	38.33	-26.85	770	705	620
St089	Gastromar	22/07/2023	12:56	15:24	38.329	-26.824	38.333	-26.831	1050	840	780
St090	Gastromar	22/07/2023	15:42	16:43	38.358	-26.867	38.36	-26.868	730	740	150
St091	Gastromar	22/07/2023	16:58	18:52	38.35	-26.88	38.354	-26.88	640	560	400
St092	Gastromar	23/07/2023	09:44	11:11	38.708	-26.719	38.705	-26.724	470	681	520
St093	Gastromar	23/07/2023	11:28	13:39	38.709	-26.667	38.702	-26.665	900	605	810
St094	Gastromar	23/07/2023	13:55	15:42	38.706	-26.676	38.699	-26.671	708	503	850
St095	Gastromar	23/07/2023	16:10	17:36	38.718	-26.772	38.714	-26.768	640	467	540
St096	Terceira S	24/07/2023	10:34	10:30	38.515	-27.119	38.515	-27.119	609	602	70
St097	Terceira S	24/07/2023	11:57	13:39	38.521	-27.082	38.522	-27.076	564	568	530
St098	Terceira S	24/07/2023	14:04	15:53			38.434	-27.085	853	809	
St099	Terceira S	24/07/2023	16:14	17:27	38.457	-27.11	38.455	-27.104	643	713	530
St100	Terceira S	24/07/2023	17:57	19:17	38.538	-27.049	38.533	-27.045	502	529	620
St101	Beirada de fora	25/07/2023	09:54	10:51	38.567	-26.714	38.56	-26.712	489	470	840
St102	Beirada de fora	25/07/2023	11:36	13:13	38.527	-26.658	38.518	-26.658	802	878	950
St103	Beirada de fora	25/07/2023	13:34	15:10	38.547	-26.664	38.539	-26.668	634	616	900
St104	Beirada de fora	25/07/2023	15:31	16:43	38.573	-26.694	38.573	-26.697	714	708	260
St105	Beirada de fora	25/07/2023	16:58	18:01	38.568	-26.693	38.568	-26.694	560	602	120
St106	Gastromar	26/07/2023	11:20	13:17	38.398	-27.051	38.4	-27.048	739	818	330
St107	Gastromar	26/07/2023	13:33	15:32	38.369	-27.048	38.367	-27.044	757	739	440
St108	Gastromar	26/07/2023	16:13	18:08	38.451	-27.002	38.454	-26.994	776	804	790
St109	Terceira NE	27/07/2023	09:02	10:29	38.788	-27.002	38.789	-26.996	619	680	470
St110	Terceira NE	27/07/2023	10:59	12:20	38.8	-27.019	38.799	-27.016	828	833	260
St111	Terceira NE	27/07/2023	12:52	13:59	38.749	-26.963	38.752	-27.959	488	519	500
St112	Terceira E	28/07/2023	09:28	10:49	38.712	-26.888	38.717	-26.878	513	595	970

			Time		Start position		End position		Depth		Dist.
St	Location	Date	Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)	Start	End	(m)
St113	Terceira E	28/07/2023	11:10	13:01	38.679	-26.845	38.679	-26.831	412	384	1230
St114	Maçarico	28/07/2023	13:40	14:21	38.722	-26.81	38.72	-26.81	594	594	260
St115	Gastromar	29/07/2023	09:56	11:36	38.480	-26.972	38.482	-26.962	736	618	840
St116	Gastromar	29/07/2023	11:55	13:58	38.446	-26.973	38.449	-26.966	709	704	700
St117	Terceira E	29/07/2023	14:49	16:04	38.556	-26.862	38.554	-26.867	496	369	450
St118	Terceira E	29/07/2023	16:42	18:38	38.591	-26.946	38.589	-26.943	662	635	280
St119	Terceira S	30/07/2023	10:03	11:20	38.530	-27.165	38.533	-27.160	539	540	480

1.4 REPORT OF THE MT PHYSETER LEG 1

1.4.1 Summary of MT Physeter Leg 1

Objective: to conduct a rapid appraisal of the deep-sea benthic communities dwelling on the banks and seamounts south of Faial and Pico Islands on board the MT Physeter, together with some dives around Faial and Pico islands' slopes. 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 27 dives with the Azor drift-cam down to 960 m depth, covering 15.9 km of the seafloor and producing 27:26 hours of video footage.

Vessel: MT Physeter

Dates: 15-21 May 2023

Scientific team: Telmo Morato, Carlos Dominguez-Carrió (chief scientists), Luís Rodrigues, Guilherme Gonçalves, Inês Carneiro, Manuela Ramos, João Balsa, Marc Pladevall, Laurence Fauconnet, Inês Bruno, Gal·la Edery.

Figure 5. Scientific team on the MT Physeter that participated in the Leg 1 of the MapGES 2023 cruise

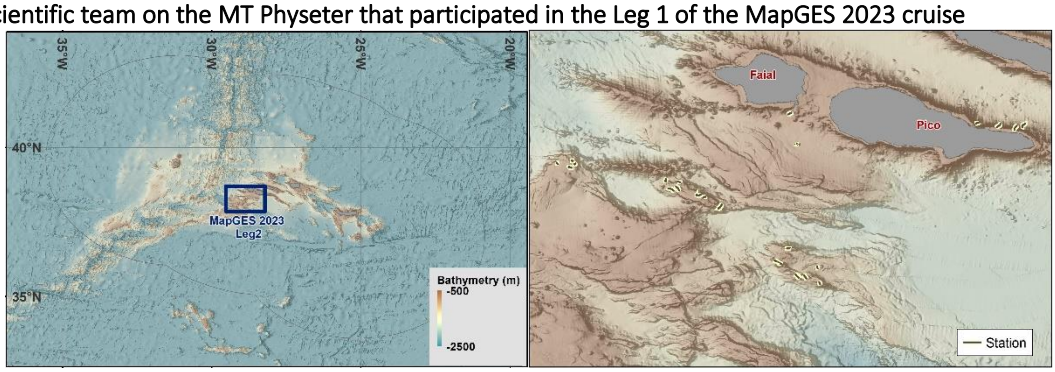

Figure 6. Location of the 27 video transects (black lines) carried out with the Azor drift-cam during Leg 1 of MapGES 2023 MT Physter survey.

Figure 7. Screenshots taken from the footage recorded during Leg 1 of MapGES 2023 MT Physeter cruise. (a) aggregation of the bird's nest sponge Pheronema carpenteri with an associated starfish; (b) Narella versluysi and Narella bellisima garden; (c, d) Large demosponges of the genus Characella; (e) Extensive field of the hexactinellid Asconema fridsteti; (f) Aggregation of cf. Candidella imbricata and Narella versluysi; (g) Large colony of the primnoid coral Callogorgia verticillata (h); Small deep-sea shark Dalatias licha

1.4.2 Cruise diary of MT Physeter Leg 1

15 May 2023

The first day of Leg 1 of MapGES 2023 cruise was aimed to test and practice the operation of the Azor drift-cam in the MT Physeter. We brought an extended crew of young scientist to train how to operate the Azor drift-cam. We left Horta harbour at around 09:00 towards a deep flat area south of Faial Island. We performed the first official dive (St001) of MapGES 2023 drifting mostly over soft bottoms from about 600m until 400m depth. We then revisited a conical seamount south of Faial that was first explored in 2021 where we had performed two short transects. In most of the dives, the seafloor was covered by soft sediments supporting low biodiversity

of megabenthic taxa. We essentially spotted some echinoderms on sandy substrate and when occasional rocky outcrops appeared, these were sparsely colonized by smaller and encrusting sponges. In some of them we also found small colonies of *Hemicorallium niobe* and, more rarely, larger sponges that comprise the *Characella pachastrelloides* complex. Most people had the opportunity to practice the different stages of the drift-cam operation. We experienced some problems in the beginning of the day and lost one RCA-HDMI adapter and one USB station. The umbilical got caught on the winch several times which caused some damage to the electric cable. We started transiting back to Horta at 18:20 and arrived at port at 19:00.

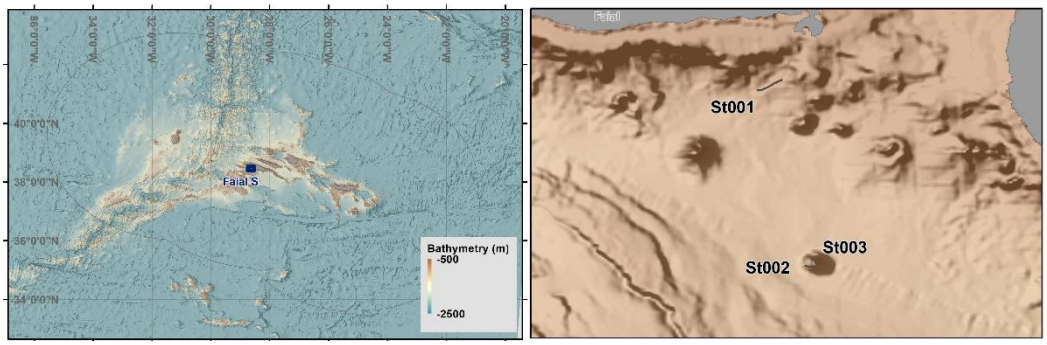

Figure 8. Map showing the dives conducted on the first day of Leg 1 of MapGES 2023 MT Physeter cruise South of Faial

Figure 9. Screenshots taken from the video footage recorded during day 1 of Leg 1 of MapGES 2023 cruise in Faial S

16 May 2023

This was the first day of real deep-sea exploration with the Azor drift-cam in 2023. We left Horta harbour at around 08:00 towards São Mateus de Fora. Similarly to the previous day, we brought an extended scientific crew to continue the familiarization with the operations of the Azor drift-cam from the MT Physeter. We arrived at the western side of São Mateus de Fora seamount at around 10:30. We performed 4 dives between 430 m and 830 m depth on two different ridge-like structures. The first dive was deployed without the depth and temperature logger. We explored areas of soft bottoms covered with coral rubble and rocky outcrops in the uphill sections of the dives. On softer sediments, the faunal assemblage was poorer and mainly consisting of

the common bird's nest sponge *Pheronema carpenteri*. As the dives progressed towards steeper sections, aggregations of *Narella versluysi* and *Narella bellissima* were spotted, as well as some sponges of the species *Macandrewia azorica*, the genus *Geodia* and large lithistids (cf.) colonizing basaltic outcrops, together with numerous smaller and encrusting sponges. Similarly to yesterday, the umbilical got stuck on the winch several times which damaged the electric cable. We started transiting back to Horta at 18:00 and arrived on shore at around 19:30.

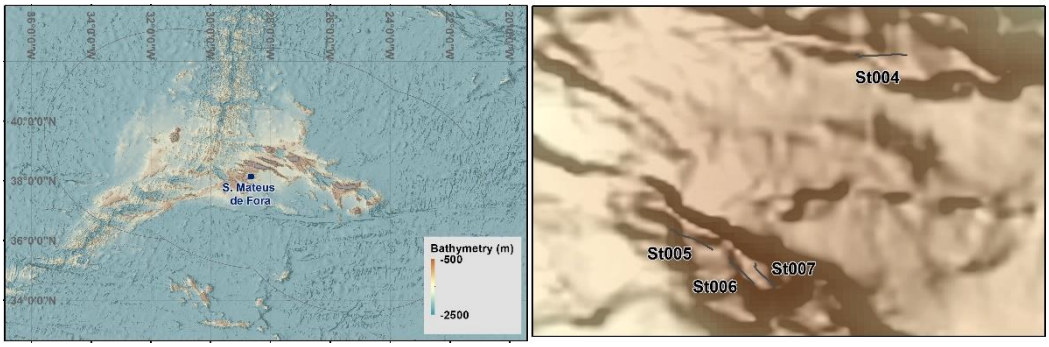

Figure 10. Map showing the dives performed in São Mateus de Fora on day 2 of Leg 1 of MapGES 2023

Figure 11. Screenshots taken from the video footage recorded during the second day of Leg 1 of MapGES 2023 cruise in São Mateus de Fora

17 May 2023

We continued exploring the São Mateus de Fora seamount, with a focus on the eastern side of the structure. We left Horta harbour at around 08:00 and started the first dive of the day at around 10:15. We conducted 5 dives with the Azor drift-cam throughout the day, between 530 and 930 m depth. The second dive was aborted due to a poor drift downhill of the seamount and towards the wrong direction. Despite this, some interesting faunal assemblages were observed during the day. On the deepest areas explored (~930 m; St012), some bamboo corals *Acanella arbuscula* were found colonizing the sea-floor, along with some glass sponges (e.g. *Regadrella phoenix*). However, this community was clearly dominated by the primnoid cf. *Candidella imbricata*, which formed large and dense coral gardens, with some *Narella versluysi* colonies as well. On shallower dives, (~700 m; St010 and St011), benthic fauna was mostly comprised by *Narella versluysi, Narella bellissima* and some colonies of *Hemicorallium niobe* and the glass sponge *Pheronema carpenteri* together with other, more occasional species (e.g. *Characella pachastrelloides* complex, *Regadrella phoenix* and *Farrea occa*). We also spotted a large *Asconema fristedti* field after drifting over the top of the crest we were exploring (St011). We started transiting back to Horta at 18:00 and arrived on shore at around 19:30.

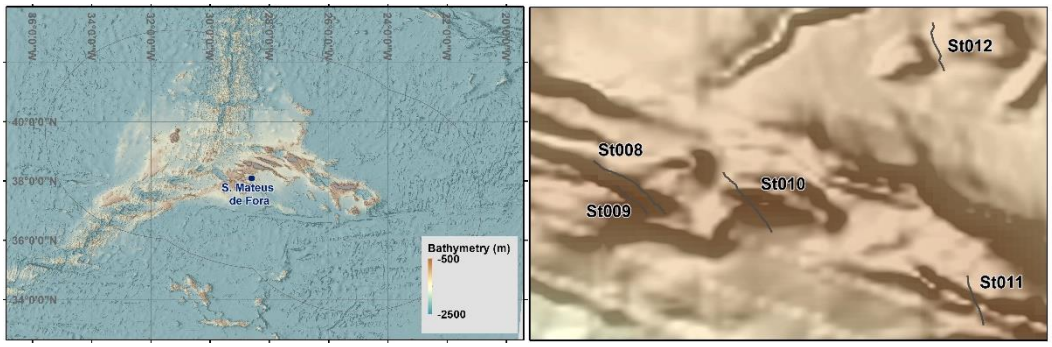

Figure 12. Map showing the location of the dives performed during day 3 of MapGES 2023 cruise in São Mateus de Fora

Figure 13. Screenshots taken from the video footage recorded during day 3 of Leg 1 of MapGES 2023 cruise in São Mateus de Fora

18 May 2023

We decided to start exploring an area named 18 Milhas (as in 18 nautical miles from shore). This area, like most of the areas south of Faial and Pico Islands, are extensively used by local bottom longliners and handliners, making exploration challenging due to potential entanglements on lost fishing lines. We started exploring the western flank of the structure where we conducted 4 dives between 515 and 1010 m depth. The drift of the last dive did not go as planned, bringing the Azor drift-cam down the slope into flat areas. We covered both soft bottoms and hard, basaltic outcrops, which were colonized by different benthic fauna communities. On soft substrate, we observed extensive sponge fields containing *Pheronema carpenteri* (including a large section of dead specimens) and *Hyalonema (Cyliconema) thomsonis*. Hard substrates were frequently colonized by a diverse sponge community composed of *Pheronema carpenteri*, *Macandrewia azorica, Regadrella phoenix, Farrea occa* and *Stylocordilla pellita*. Some large colonies of *Callogorgia verticillata* – some of them dead or damaged – were also present. We started transiting back to Horta at 18:30 and arrived on shore at around 20:00.

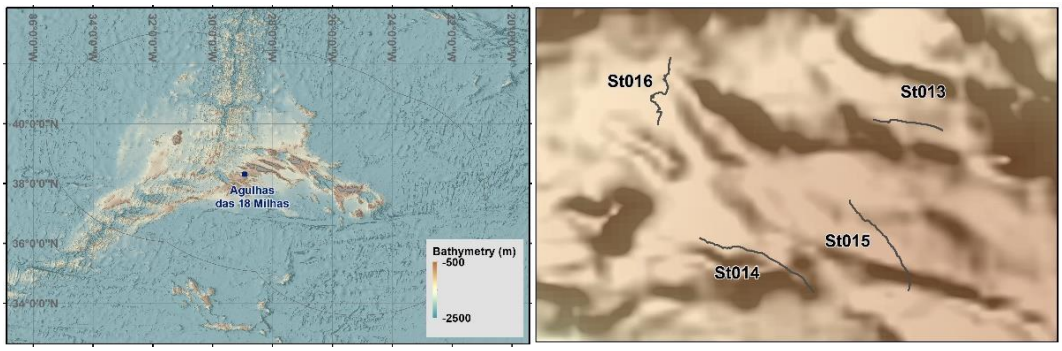

Figure 14. Bathymetric map showing the location of the dives from day 4 in 18 Milhas

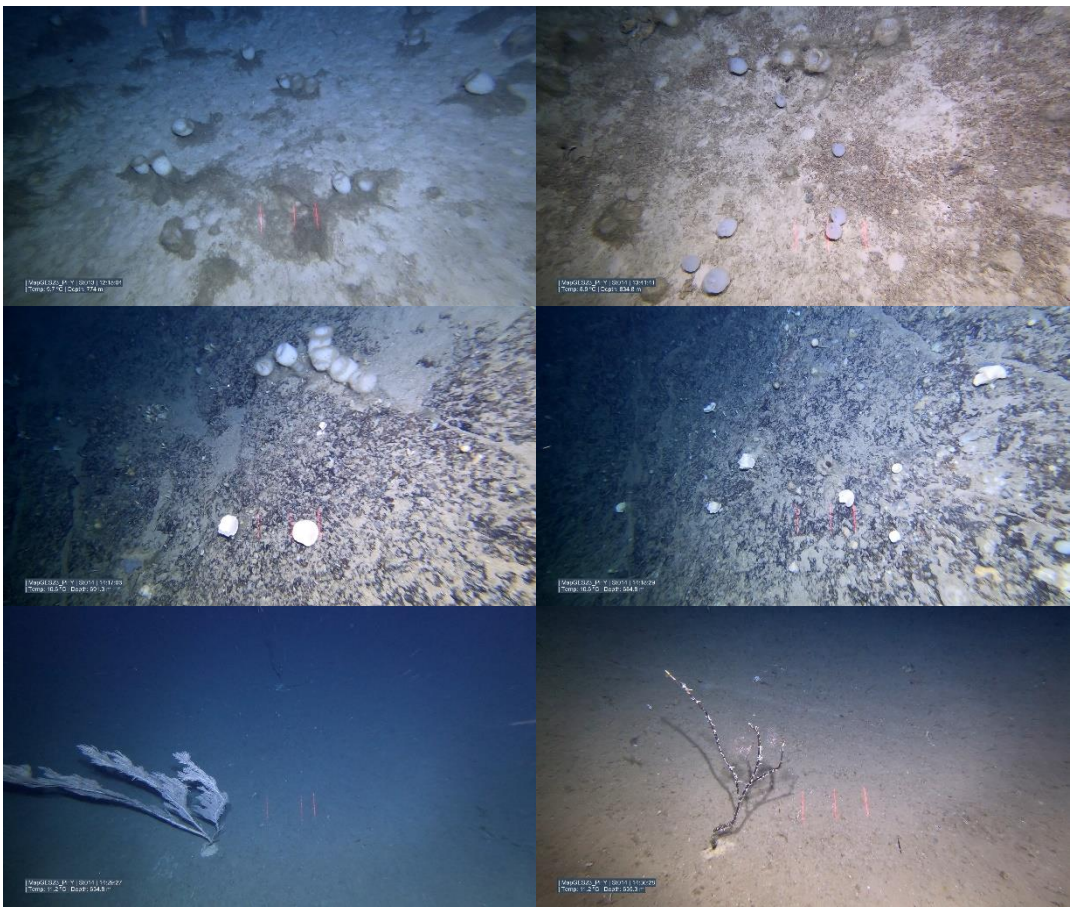

Figure 15. Screenshots taken from the video footage recorded day 4 of MapGES_2023 survey in 18 Milhas

19 May 2023

We left Horta harbour at 08:00 towards Boureé NE. We started the first dive of the day around 10:21 and conducted 4 dives between 594 and 920m. The deepest dive conducted was characterized by low biodiversity, mostly covering soft sediment and some bare basalt outcrops, except from one large but isolated *Hemicorallium tricolor* colony. Coral communities found on the remaining dives were essentially found on shallower, basaltic substrates composed of *Narella versluysi* and *Narella bellissima* together with other more sporadic species such as *Hemicorallium niobe* and *Pliobothrus symmetricus*. An aggregation of a small, pink-coloured soft coral was also present in one dive at around 600m. Some of the most frequently spotted sponge species included *Pheronema carpenteri*, *Macandrewia azorica, Regadrella phoenix, Farrea occa, Aphrocallistes beatrix* complex and *Asconema fristedti*, as well as some unidentified medium-sized demosponges.

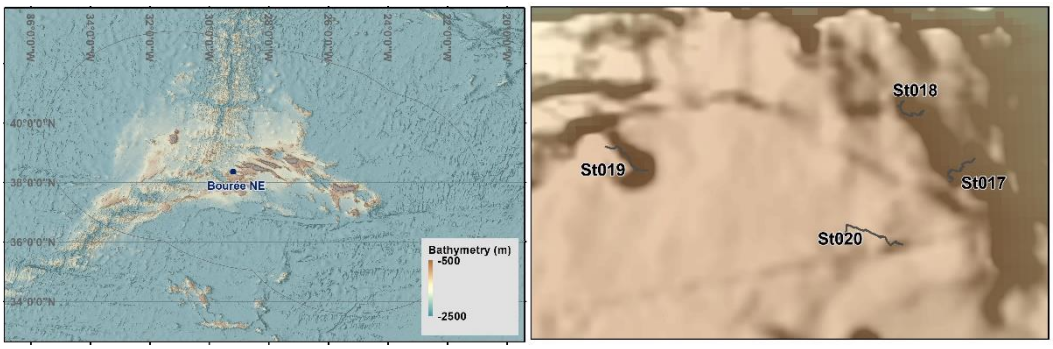

Figure 16. Bathymetric map showing the location of the dives from day 4 in Boureé NE

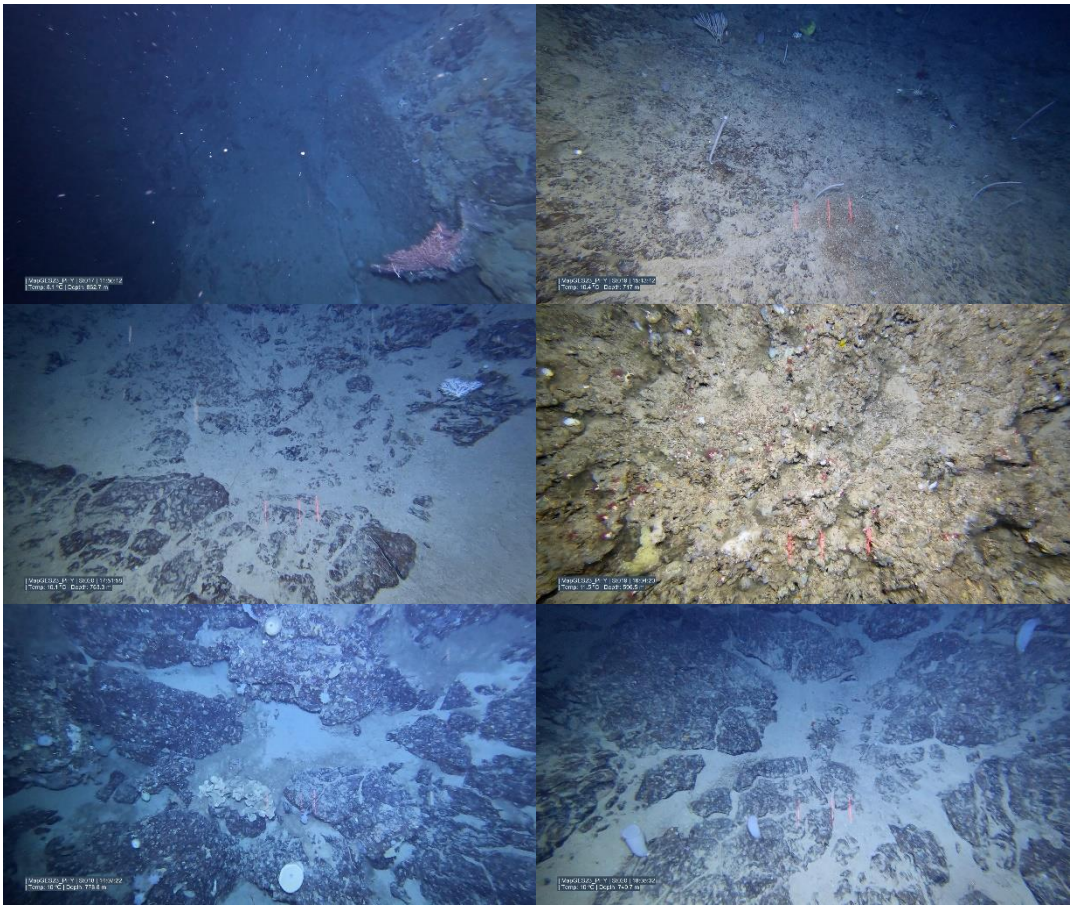

Figure 17. Screenshots taken from the video footage recorded day 4 of MapGES_2023 survey in Boureé NE

20 May 2023

We left Horta at 08:00 towards Pico NE. We started the first dive of the day at around 11:50 and conducted 4 dives between 190 and 970 m depth. The first dive of the day (St021) contained a somewhat diverse benthic community, although not very abundant. It was essentially composed by small *Acanthogorgia* spp. colonies and a relatively varied sponge assemblage, dominated by the laminate cf. *Phakellia ventilabrum*, with larger sponges of the *Characella pachastrelloides* complex, some demosponges such as *Petrosia crassa* and glass sponges of the species *Haliclona implexa* also seen colonizing the "landscape" more sporadically. We also scraped the camera system slightly on a small vertical wall (~8 m tall) which was densely colonized by crinoids of the species

Cyathidium foresti, which hung from its crevices, as well as small, white plexaurids. We also drifted over a small *Dalatias licha* at around 615 m depth. The second and deepest dive of the day (St022) was performed on flat and soft bottoms, relatively poor in terms of benthic fauna, where we only drifted over occasional foraminifera from the species *Syringammina fragilissima*, the glass sponge *Pheronema carpenteri* and some ceriantharia. The final dives of the day (St023 and St024) were quite similar in terms of faunal assemblage, particularly on shallower sections. The frequent rocky outcrops found here were densely covered in sediments, something typical of island slopes. These were mainly colonized by some sponges such as *Macandrewia azorica, Haliclona implexa* and *Petrosia crassa*, along with smaller and encrusting sponges.

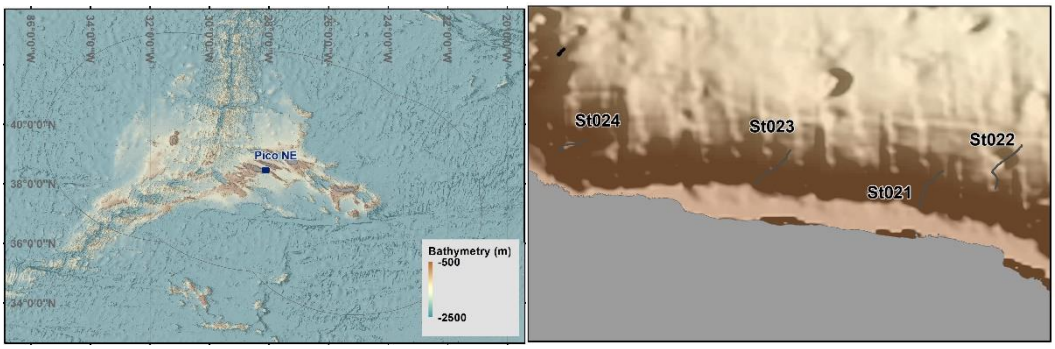

Figure 18. Map showing the location of the seamount and the position of the dives performed during day 5 of MapGES_2023 cruise in Pico NE

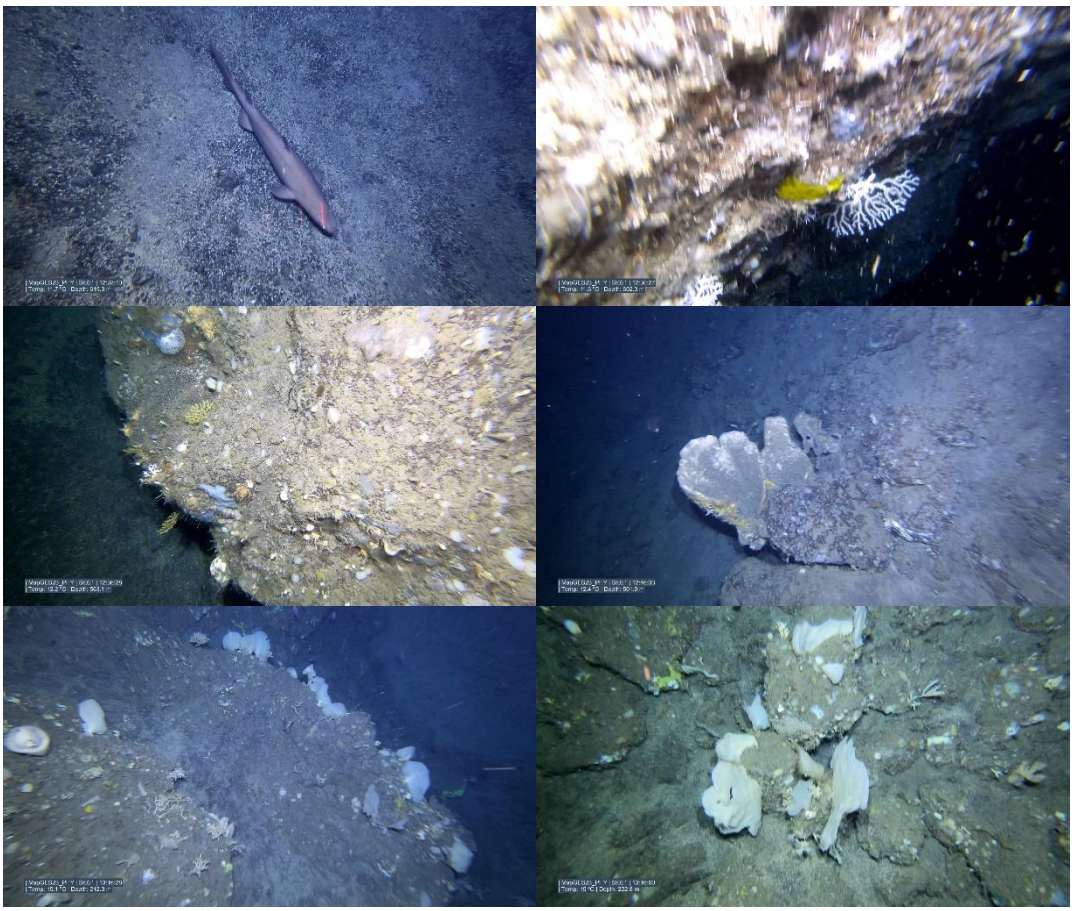

Figure 19. Screenshots taken from the video footage recorded in Pico NE

21 May 2023

We transited to 18 Milhas and conducted only 3 dives with the Azor drift-cam throughout the day, between 420 and 980 m depth. During the first dive conducted (St025) we drifted over some lace corals of the species *Errina dabneyi*, which seems to be endemic of the Azores archipelago, and sparse *Callogorgia verticillata* and *Viminella flagellum* colonies. Apart from this, the benthic community spotted was essentially composed of sponge fauna, containing large specimens of the *Characella pachastrelloides* complex, *Neophrissospongia nolitangere*, and many encrusting sponges colonizing hard basaltic substrates. The second dive (St026) recorded a similar faunal assemblage as the previous dive, only poorer in terms of abundances. On the third and final dive of the day (St027), we spotted small aggregations of the bird's nest sponge *Pheronema carpenteri* on a relatively steep slope, along with other sponges such as *Regadrella phoenix*, *Macandrewia azorica* and *Stylocordilla pellita.* While using the structure #3 for the first time during this dive, the Azor drift-cam got caught on a lost fishing longline. After a few attempts, we were able to release the system only losing the weight. On board we realised that one of the concentric lights was flooded, which meant that we had also lost the LED and the corresponding battery. The new Outland laser system was also flooded but with no apparent relation to the entanglement. After recovering the system, we decided to go back to shore to evaluate and fix the damages.

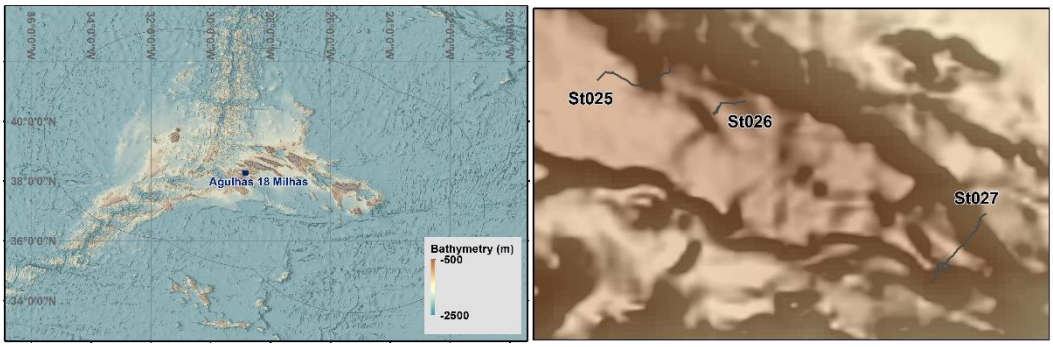

Figure 20. Location of the dives conducted in 18 Milhas on the 21st of May 2023

Figure 21. Screenshots taken from the video footage recorded in 18 Milhas on the 21st of May 2023

1.5 REPORT OF THE MT PHYSETER LEG 2

1.5.1 Summary of MT Physeter Leg 2

Objective: to conduct a rapid appraisal of the deep-sea benthic communities dwelling on the banks and seamounts south of Faial and Pico Islands on board of the MT Physeter, together with some dives around Faial and Pico islands' slopes. 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 25 dives with the Azor drift-cam down to 963 m depth, covering 14 km of the seafloor and producing 20:58 hours of video footage.

Vessel: MT Physeter

Dates: 30 May – 11 June 2023

Scientific team: Telmo Morato, Carlos Dominguez-Carrió (chief scientists), Luís Rodrigues, Inês Carneiro, João Balsa, Marc Pladevall, Guilherme Gonçalves, Laurence Fauconnet and Sérgio Gomes.

Figure 22. Scientific team on the MT Physeter that participated in the Leg 2 of the MapGES 2023 cruise

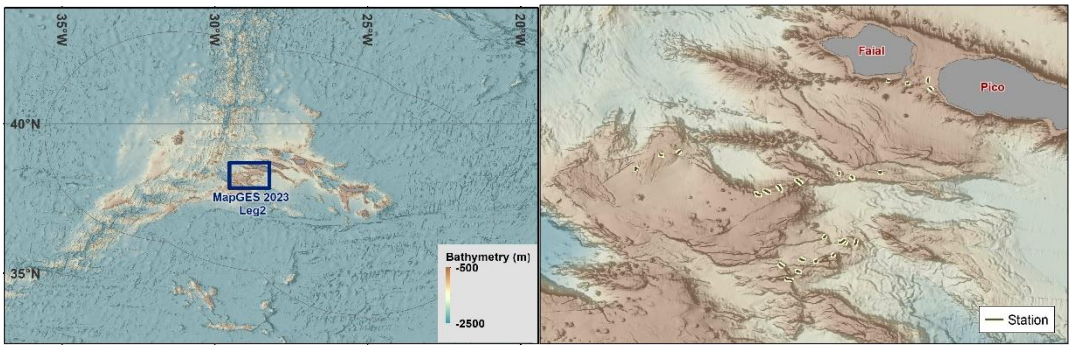

Figure 23. Location of the 25 video transects (black lines) carried out with the Azor drift-cam during Leg 2 of the MapGES 2023 cruise

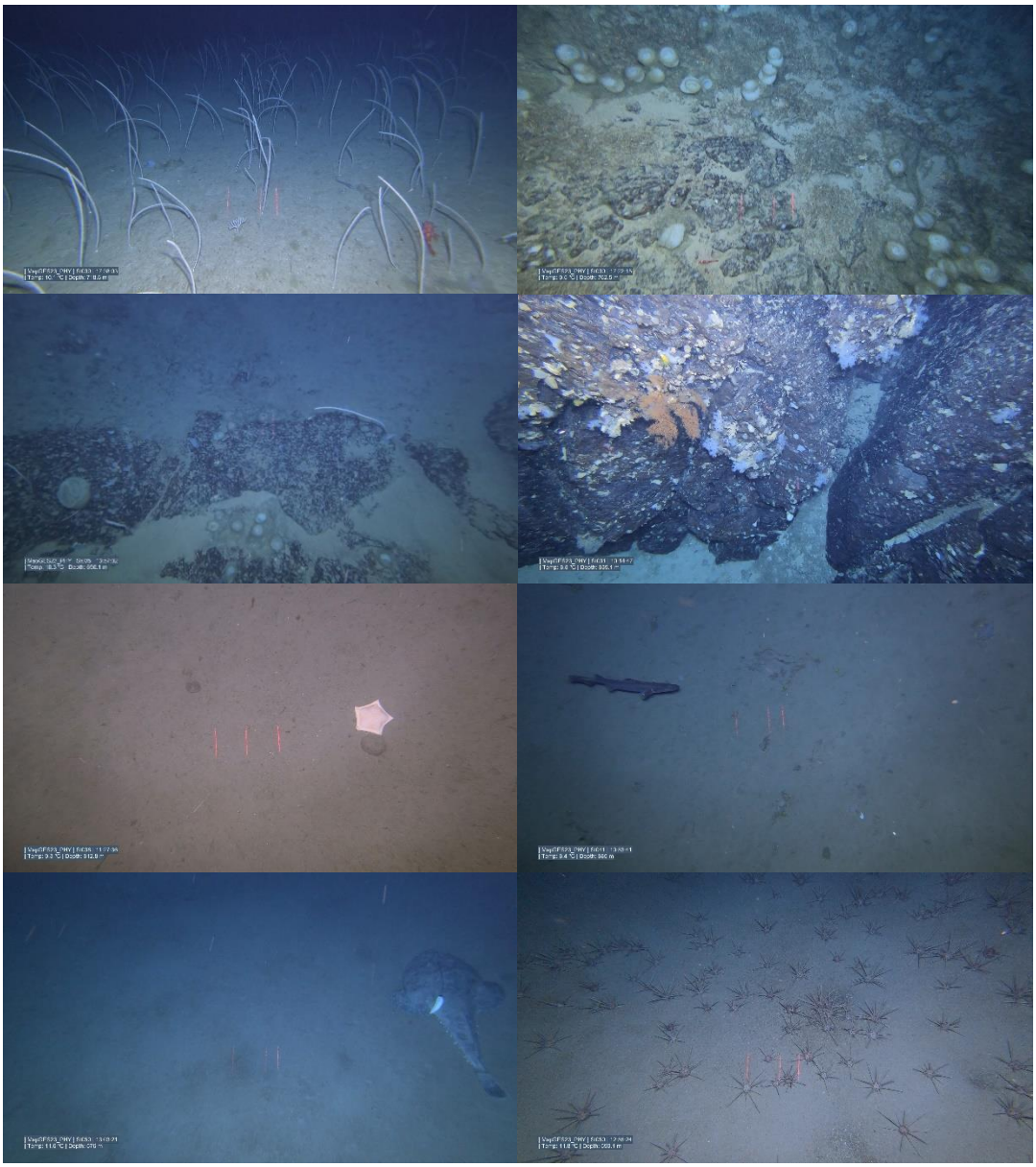

Figure 24. Screenshots taken from the footage recorded during Leg 2 of MapGES 2023 cruise. (a) Dense coral garden dominated by *Narella versluysi* (b, c); Aggregation of the glass sponge *Pheronema carpenteri* over mixed substate together with the more sporadic *Asconema fridsteti*; (d) Basaltic outcrops colonized by several small glass sponges and occasional black-corals *Leoipathes expansa*; (e) Soft grounds sparsely occupied by some foraminifera and starfish *Peltaster placenta*; (f, g) Deep-sea fish *Daenia* cf. *profundorum* and monkfish *Lophius piscatorius* on sand bottom; (h) Extensive and highly abundant patch of the echinoderm *Cidaris cidaris*

1.5.2 Cruise diary of MT Physeter Leg 2

30 May 2023

We left Horta harbour at around 9:15, in direction to De Guerne N. We started the first dive of the day at 11:11. We conducted 3 dives with the Azor drift-cam throughout the day, between 550 and 1120 m depth. During the second dive, the live-view quality was compromised, so we finished the dive earlier after 18 minutes after reaching the bottom. We spent 2:30 hours trying to find a solution: we repaired the electric cable, changed the live view connection and tested the umbilical connection but we could not fix the issue. After all these procedures the live-view connection got better, and we decided to do the third dive of the day.

Most of the steep slopes surveyed were covered by soft sediments. The benthic communities observed were dominated by some aggregations of *Pheronema carpenteri*, *Narella versluysi* and *Narella bellissima* at 700 m depth. On deeper areas, we also found *Acanella arbuscula*, *Leptopsammia formosa* and some *Hemicorallium tricolor*. But the highlight of the day was a *Narella versluysi* garden we found on the last dive. After the last dive we got back to Horta harbour and arrived on land around 20:30.

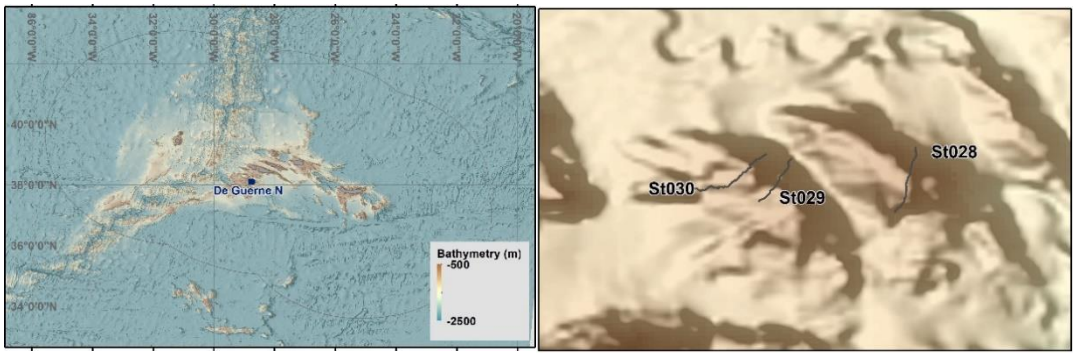

Figure 25. Location of De Guerne N and the dives conducted with the Azor drift-cam in this area, during 30 May 2023

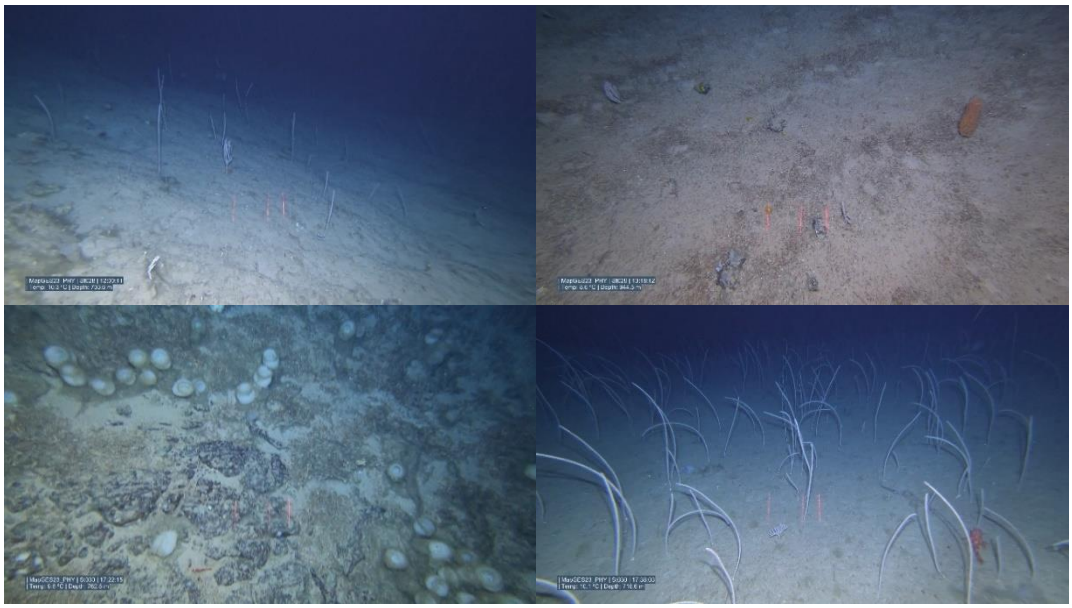

Figure 26. Screenshots extracted from the video footage recorded with the Azor drift-cam in De Guerne N, during 30th May 2023

31 May 2023

We left Horta harbour around 8:15, in direction to De Guerne N. The first dive of the day started at 09:51. We completed a total of 3 dives during the day, between 575 and 826 m depth. During the second dive of the day, the Azor drift-cam got caught on a lost fishing longline. After a few attempts, we were able to release and recover the system with a few damages: battery from one of the lights burnt out due to water entrance, and the electric cable broke. After changing the structure and the cable we were able to perform the last dive of the day.

The seafloor observed was mainly composed of soft bottom or rocky bottom covered with sediment and coral rubble. The most common species was *Pheronema carpenteri*. There were also some *Characella pachastrelloides* complex and *Pachastrella spp*. The basaltic outcrops and vertical walls were covered in small or encrusting sponges, *Macandrewia azorica*, *Geodia* spp. In some of them we also found occasional *Leiopathes expansa* and *Hemicorallium niobe* colonies. During the second dive we also observed a wreckfish (*Polyprion americanus*). We also drifted over an interesting aggregation of *Narella belissima* with *Narella versluysi*. We arrived at Horta harbour around 19:30 after encountering a group of common dolphins on the way.

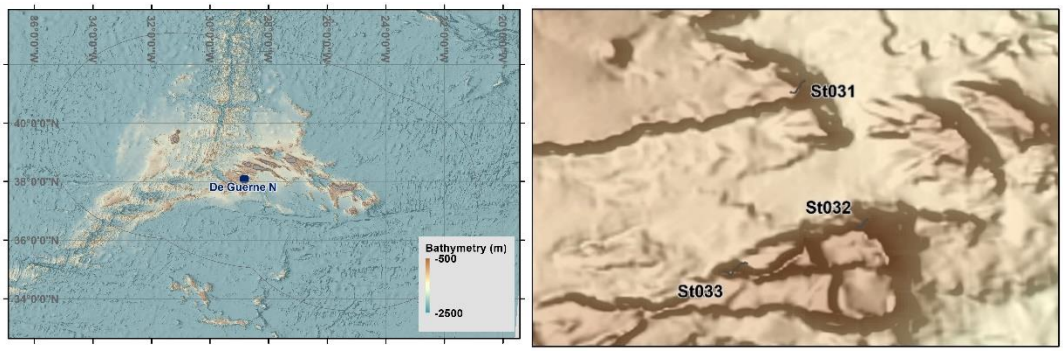

Figure 27. Location of De Guerne N and the dives conducted with the Azor drift-cam in this area, during 31 May 2023

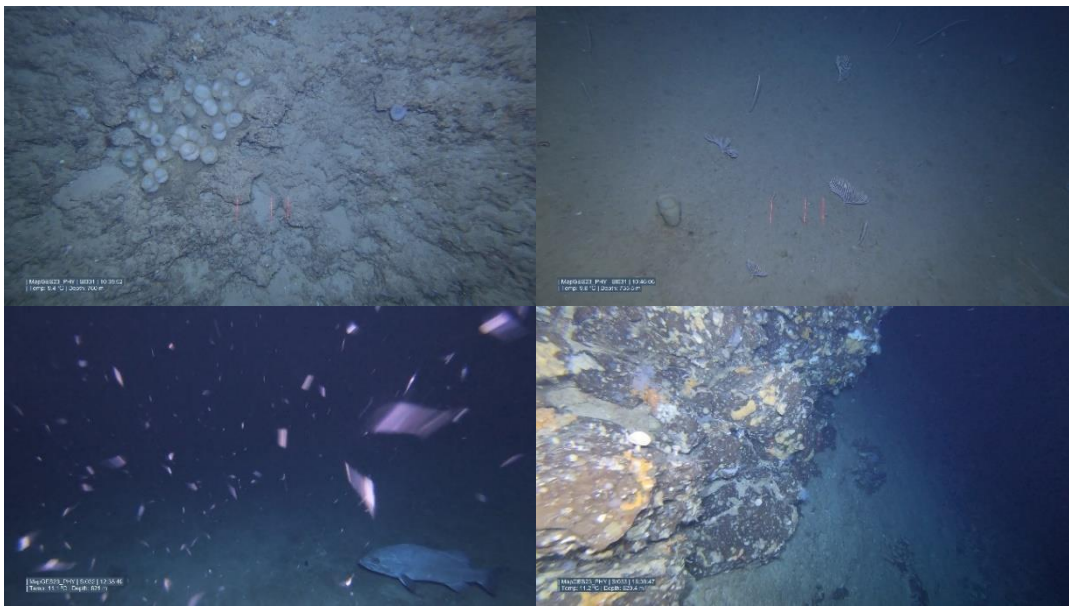

Figure 28. Screenshots extracted from the video footage recorded with the Azor drift-cam in De Guerne N, during 31 May 2023.

1 June 2023

We started the first dive of the day at 11:17, after leaving Horta harbour around 8:30. We performed 4 dives at De Guerne N. The first two dives were characterized by basaltic outcrops covered with sediment and coral rubble, while the last two where mainly soft bottom with some coral rubble. First dive had the lowest biodiversity, with mainly some encrusting sponges. The most common species during the second and third dives was *Pheronema carpenteri.* We also spotted *Hemicorallium niobe* and some big sponges such as *Pachastrella spp*. and some that we identify as part of the *Characella pachastrelloides* complex. When going up from the 720m to the 600m depth we noticed an aggregation of *Narella belissima* with *Narella versluysi* and *Asconema fristedti*, which were the highlight of the day. At 600m we also found some *Desmacella grimaldii,* sponges belonging to the genus *Geodia* and a *Paromola cuvieri* not carrying any coral or sponge on its back. The deepest dive of the day was the last one, where at the 930m we observed one *Leiopathes expansa* with an associated *Sternostylus formosus*. We finished the last dive around 17:40 and started transiting to Horta harbour where we arrived at 19:30.

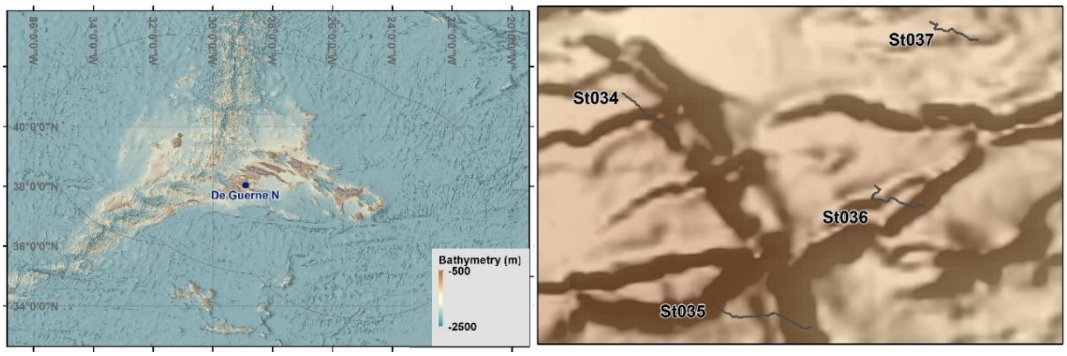

Figure 29. Location of De Guerne N and the dives conducted with the Azor drift-cam in this area, during 1st of June 202

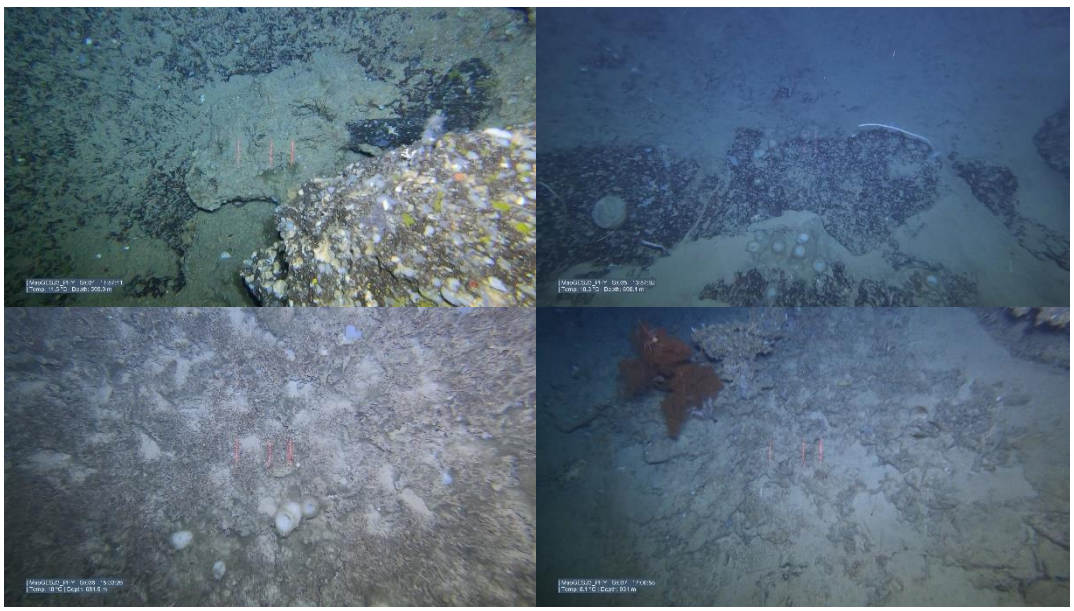

Figure 30. Screenshots extracted from the video footage recorded with the Azor drift-cam in De Guerne N, during 1st of June 2023

2 June 2023

We left Horta harbour around 8:15. After almost reaching Castelo Branco we decided to cancel the fieldwork day due to rough sea conditions. The swell was heavy, and the drift was too strong to operate the Azor drift-cam. We got back to Horta harbour around 9:20 and, after a coffee, we went back to work in DOP.

3 June 2023

We left Horta harbour at around 8:15, in direction to Boureé NE. We started the first dive of the day at 11:08, after a bumpy ride due to heavy swell. We completed a total of 3 dives, between 690 and 860 m depth. Before the last dive of the day, we were having difficulties with one of the screws from the GoPro waterproof case, and since we were unable to fix it, we tried to change the waterproof case unsuccessfully. After changing structure, we proceeded the work. The first two dives were performed in areas of mainly soft sediment and had generally low biodiversity. We drifted over some foraminifera from the species *Syringammina fragilissima* and some echinoderms such as *Cidaris cidaris* and *Peltaster placenta*. The outcropped bottom of the last dive, as well as some of the basaltic boulders from the first dives were mainly characterized by aggregations of the sponge *Pheronema carpenteri*. During the last dive, besides *Pheronema carpenteri* we also observed other associated species such as octocorals of the species *Hemicorallium niobe* and a small aggregation of both *Narella belissima* and *N. versluysi*. Finally, we noticed several bluemouth rockfish *Helicolenus dactylopterus*. After the last dive we headed back to Horta harbour and, after a 2 hour transit, we arrived at 20:00.

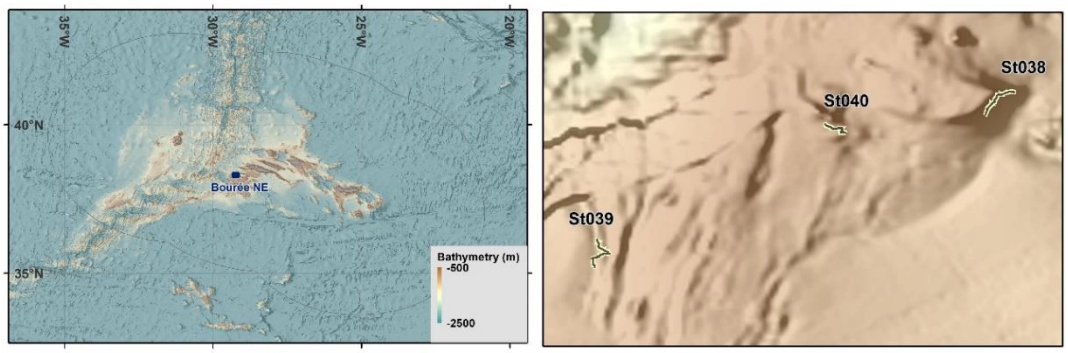

Figure 31. Location of Bourée NE and the dives conducted with the Azor drift-cam in this area, during the 3rd of June 2023

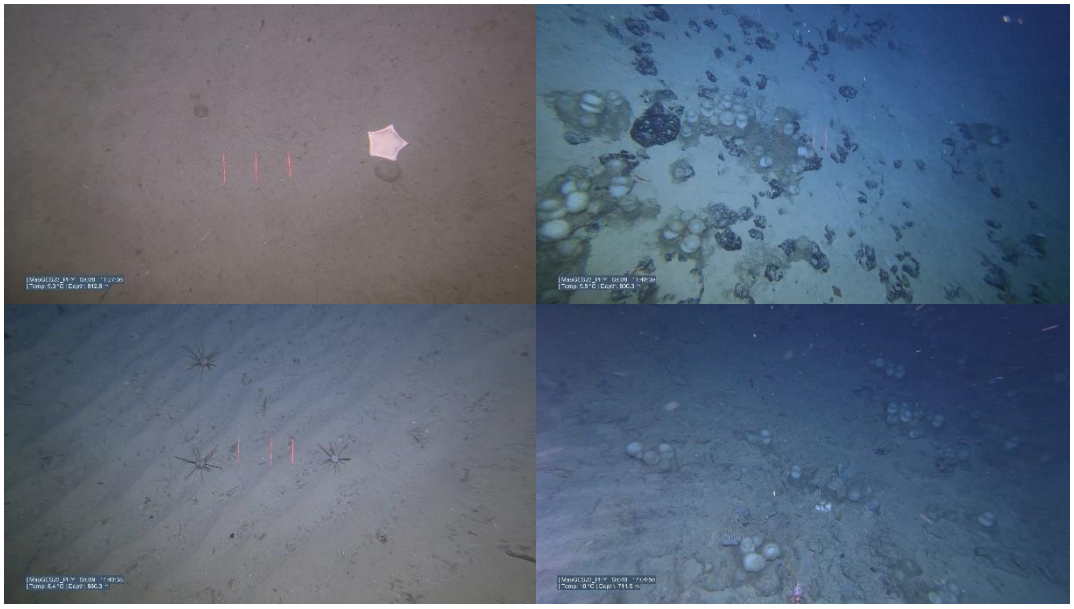

Figure 32. Screenshots extracted from the video footage recorded with the Azor drift-cam in Bourée NE, during the 3rd of June 2023

4 June 2023

We left Horta harbour at around 8:15, in direction to Agulhas 18 Milhas. When we were preparing the Azor drift-cam for the first dive of the day, we noticed the lasers were full of water and couldn't work. We decided to change structure, however, the connections on the live view cylinder weren't working, so we had to change the cylinder before starting the first dive of the day. We completed 3 dives, between 722 and 929 m depth. The first dive started around 10:03 with the camera system landing in sedimentary areas covered in coral rubble, moving towards consolidated sedimentary rock by the end. This dive was characterized by aggregations of the sponges *Pheronema carpenteri, Hyalonema (Cyliconema) thomsonis* and other glass sponges (e.g., *Farrea occa*). We also noticed the presence of some cup corals such as *Leptopsammia formosa* and occasionally the foraminifera *Syringammina fragilissima.* After finishing the first dive, we moved towards Agulhas 12 Milhas where we performed the last two dives of the day. These two dives were very distinct, with the first one (St042) being characterized by a basaltic outcropped bottom covered with sediment and coral rubble, with a lot of associated benthic fauna, and the last one (St043) being of sandy nature with only eel-like fishes and some occasional sea urchins *Cidaris cidaris*. During the second dive, we could observe some small sponges such as *Farrea occa*, as well as large aggregations of *Pheronema carpenteri* associated with the primnoid *Hemicorallium niobe.* We also drifted over several fishes during the day including: *Chaunax pictus*, *Mora moro*, *Hoplostethus mediterraneus* and a shark belonging to the genus *Deania*. We started transiting back to Horta at around 17:00, after the last dive, arriving around 18:00. During the trip back we encountered a group of common dolphins to wrap up the day.

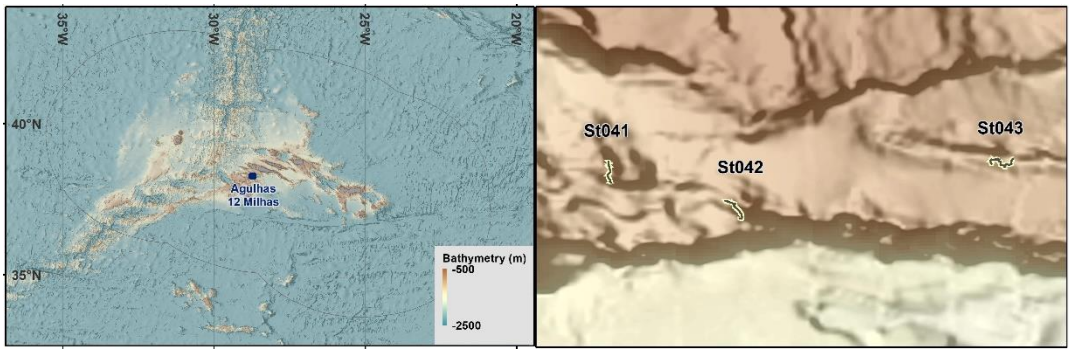

Figure 33. Location of Agulhas 12 Milhas and the dives conducted with the Azor drift-cam in this area, on the 4th of June 2023: St041 (Agulhas 18 Milhas); St042 and St043 (Agulhas 12 Milhas)

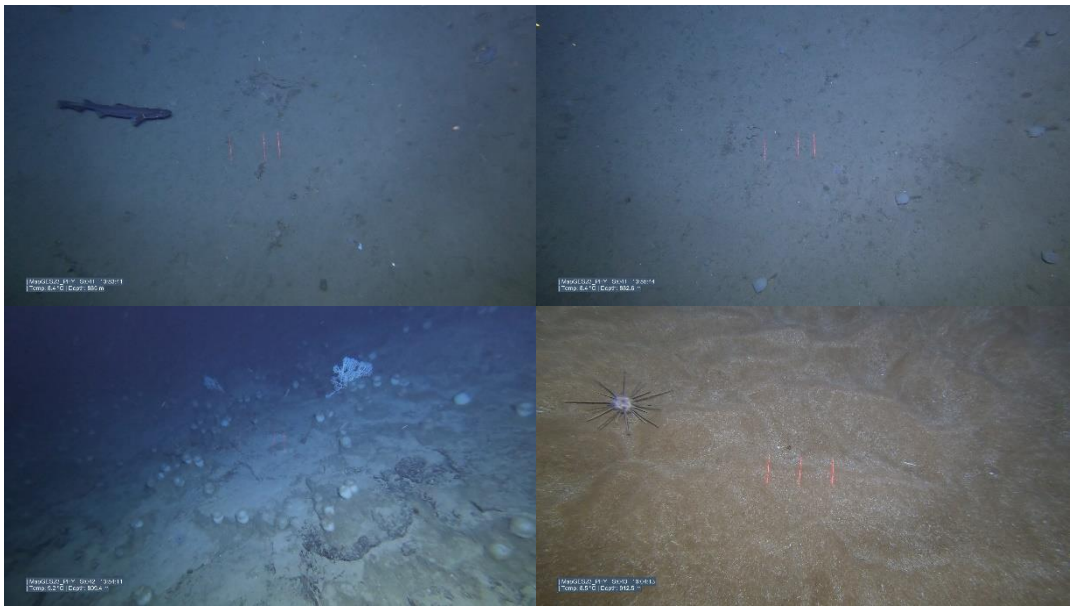

Figure 34. Screenshots extracted from the video footage recorded with the Azor drift-cam in Agulhas 18 Milhas (St041) and Agulhas 12 Milhas (St042 and St043), during the 4th of June 2023

5 June 2023

Today, we achieved a long waiting milestone: teaching our South Atlantic partners how to operate the Azor drift-cam. The iAtlantic capacity building workshop aimed to share the technological and methodological details for the use of the Azor drift-cam. It ran from 5-8th June 2023 in the facilities of Escola do Mar (EMA) in the city of Horta (Faial Island, Portugal). A total of 12 researchers from the iAtlantic consortium coming from Brazil, South Africa and the United Kingdom took part in the workshop organized by the Azores Deep-Sea Research group. All the expenses were covered by the iAtlantic project. The workshop included two half-a-day surveys on board of a small local vessel to show the participants how to deploy the Azor drift-cam in real conditions and how to operate the system to effectively collect video footage of deep-sea benthic habitats.

Today, a total of 2 deployments were performed with our Brazilian partners between 11:30 and 16:30. Due to the harsh weather conditions we performed the dives in the channel between Faial and Pico islands, shallower than usual. The images collected revealed that habitats of the island slopes found at 200-300 m depth are characterized by mixed substrates with a dominance of sponge species, where several deep-sea sharks and demersal fishes could be spotted.

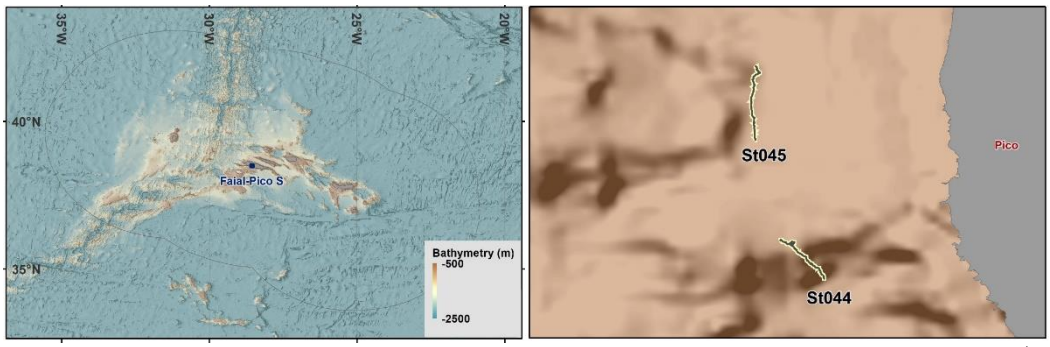

Figure 35. Location of Faial-Pico S and the dives conducted with the Azor drift-cam in this area, during the 5th of June 2023

Figure 36. Screenshots extracted from the video footage recorded with the Azor drift-cam in Faial-Pico S, during the 5th of June 2023

8 June 2023

We finally had some less harsh weather that allowed us to go to the sea with the south African partners participating in the Azor drift-cam workshop. We also had the chance to welcome the Rolex filming crew that were interested in taking some images of this capacity building event.

Due to having many people onboard, the operations were a little bit more frantic than usual. Nevertheless, all the tasks went by relatively smoothly. We started the day by heading towards Porto Pim bay in order to allow the Rolex team to get some underwater images of a simulated deployment of the Azor drift-cam. After this, we headed to the location of the first dive of the day and used the time in transit to show the workshop trainees how to make the necessary preparations for the system to be operational upon arrival to the site. We performed two successful dives during the day, between 170 and 250 m depth on the southern slopes of Faial Island, close to Monte da Guia hill. Both drifts went smoothly and fauna wise, the images recovered revealed interesting benthic communities usually found colonizing island slopes, commonly covered by high quantities of sediment.

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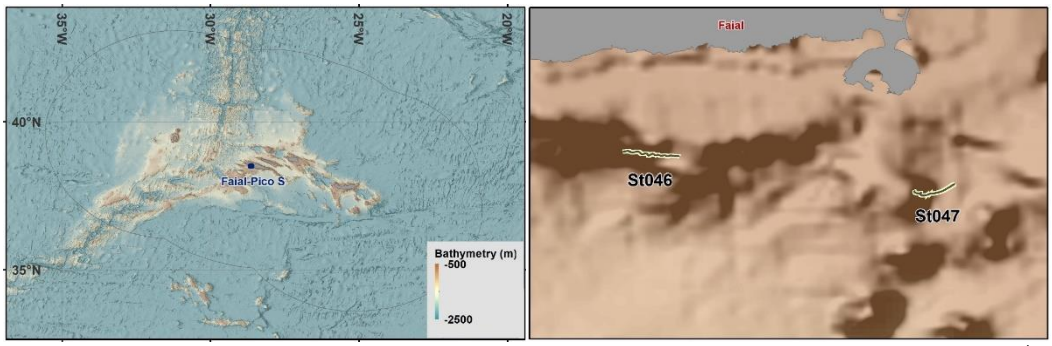


Figure 37. Location of Faial-Pico S and the dives conducted with the Azor drift-cam in this area, during the 8th of June 2023

Figure 38. Photos of the scientific team with the workshop participants from the South Africa team, taken during the field work on the 8th of June 2023

10 June 2023

We left Horta harbour around 8:00 heading to Açor seamount. According to our map, this seamount was expected to have strong fishing activity, so we were expecting some troubles with lost fishing lines. Fortunately, we performed two dives with no major incidents. However, 1 minute after starting the first dive of the day, we had to abort it after losing the live view image. When the Azor drift-cam got back on the surface we noticed that the GitUp waterproof case was still open, and water got in the case, breaking the GitUp and its battery. After drying the case, changing the electric connections and the GitUp camera, we were able to continue working. During this fieldwork day we had Pepe Brix onboard filming our work.

First successful dive (St049) was characterized by soft sediment covered with coral rubble. During most of the dive we could only spot small or encrusting sponges, however, when we started to go up the hill, we noticed an interesting association of the black coral *Elatopathes abietina* with the whip coral *Viminella flagellum*. But the highlight of the day occurred during the last dive, especially because the live view image had low quality and after watching the GoPro video, it came as a surprise when we observed a big and dense aggregation of *Cidaris cidaris*. Regarding fish, we were able to collect good quality images of the flat fish *Arnoglossus rueppeli*, monkfish (*Lophius piscatorius*), *Coelorinchus caelorhincus*, a shoal of *Epigonus sp*. and several shoals of *Capros aper*. After this last dive, Physeter skipper spoke with the chief scientist, and both decided it was better to go back to Horta due to due to increased wind and rough sea conditions. We arrived at Horta harbour at around 17:00.

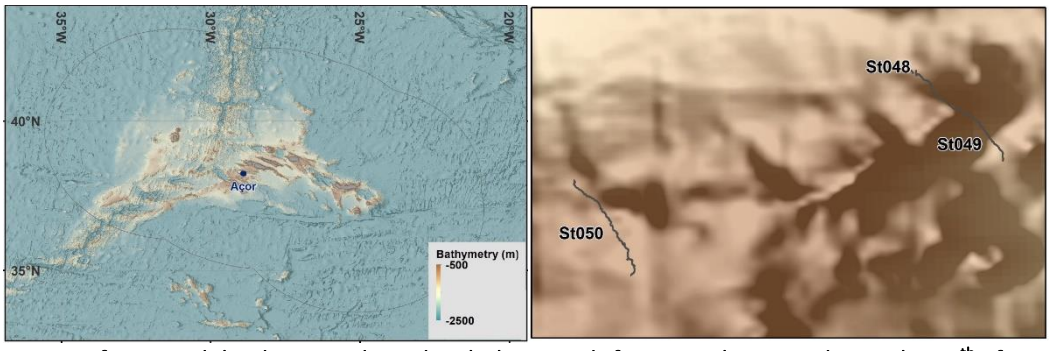


Figure 39. Location of Açor and the dives conducted with the Azor drift-cam in this area, during the 10th of June 2023. Dive identified as St048 was aborted so we performed St049 at the same location

Figure 40. Screenshots extracted from the video footage recorded with the Azor drift-cam in Açor, during the 10th of June 2023

11 June 2023

After finishing work earlier, the day before, we went back to Açor seamount, leaving Horta harbour at 8:00. We started the first dive of the day at 10:05, in a shallow area (300 – 550 m depth). During the first part of this dive, we encountered generally low biodiversity, characteristic of sedimentary bottoms, such as: *Ceriantharia sp*., and several fish: *Arnoglossus rueppeli*, *Coelorinchus caelorhincus* and *Capros aper*. When we reached shallower areas (around 300m) we found some basaltic outcrops with a considerable number of sponge species like: *Characella*, *Leiodermatium*, *Pachastrella* spp. and *Phakellia ventilabrum*. During the second dive, the Azor drift-cam landed on an outcropped area covered with sediment. Here we observed a big variety of sponges such as *Haliclona implexa*, *Neophrissospongia nolitangere*, *Pachastrella* spp., *Phakellia ventilabrum* and other. These last two appeared associated with the whip coral *Viminella flagellum.* We also drifted by a big school of small *Epigonus sp.*

After 1 hour of bottom time, we lost the live view image, so we brought the system up as fast as we could to recover it. When the Azor drift-cam reached the surface, we noticed the problem was in the electric cable, and because we could not detect any visual damage, we decided to put the cable back in the water and carefully

examine it. After some inspection, we noticed a section that was probably broken, and we tried to fix it, unsuccessfully. Since the spare cable was not working as well, we then decided it was better to get back to Horta and cancel the next few days of fieldwork, to sort the cable and organize some missing equipment. We left Açor around 16:00, and as we approached Horta, we had one of the best unplanned whale watching experiences, as we spotted a sunfish, a group of sperm whales breaching and finally, a large group of common dolphins interacting with our vessel. We arrived in Horta harbour at 18:00, we washed the gear and packed some of the equipment to take to DOP-mar the next day.

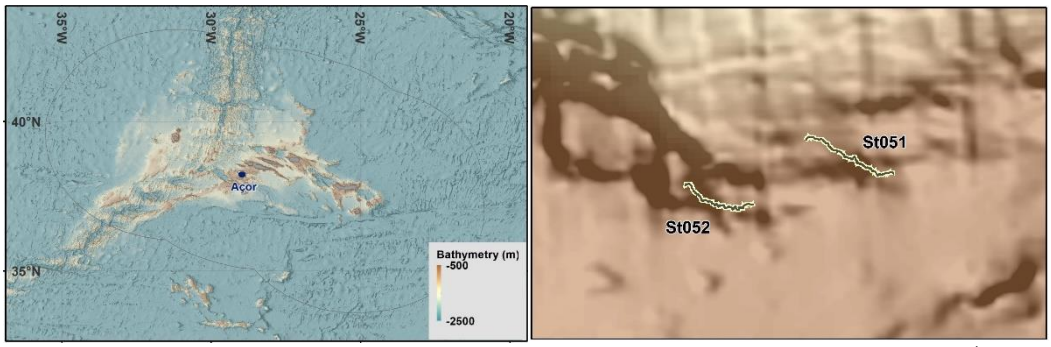


Figure 41. Location of Açor and the dives conducted with the Azor drift-cam in this area, during the 11th of June 2023

Figure 42. Screenshots extracted from the video footage recorded with the Azor drift-cam in Açor, during the 11th of June 2023

Figure 43. Photos of the sunfish and a group of common dolphins spotted during our arrival to Horta

1.6 REPORT OF THE MT PHYSETER LEG 3

The Azores deep-sea research group made extensive efforts to bring the Portuguese Research Vessel "Mário Ruivo" to the Azores to continue exploring the deep-sea benthic habitats of this region. Unfortunately, after a long period of negotiations the owner of the vessel informed us that it was not possible to pursue such a scientific campaign. The lack of the legal certifications along with logistic problems made this plan impossible. To overcome such bad outcome, we decided to send the RV Arquipélago to explore those areas that were allocated to be surveyed with the RV Mário Ruivo (e.g., Sedlo and Hard Rock Café seamounts) and to send MT Physeter to explore the slopes of Terceira Island. Leg 3 of the MT Physeter cruise, therefore, aimed to conduct a rapid appraisal of the deep-sea benthic communities dwelling on the Terceira islands' slopes and Álvaro Martins.

1.6.1 Summary of MT Physeter Leg 3

Objective: to conduct a rapid appraisal of the deep-sea benthic communities dwelling on the Terceira islands' slopes and its nearby seamounts on board of the MT Physeter. 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 67 dives with the Azor drift-cam down to 1000 m depth, covering 38 km of the seafloor and producing 71 hours of video footage.

Vessel: MT Physeter

Dates: 14 July – 30 July 2023

Scientific team: Telmo Morato, Luís Rodrigues, (chief scientists), Isabel Areosa, João Balsa, Inês Bruno, Inês Carneiro, Sérgio Gomes, Guilherme Gonçalves, and Gerald Taranto.

Figure 44. Scientific team on the MT Physeter that participated in the Leg 3 of the MapGES 2023 cruise

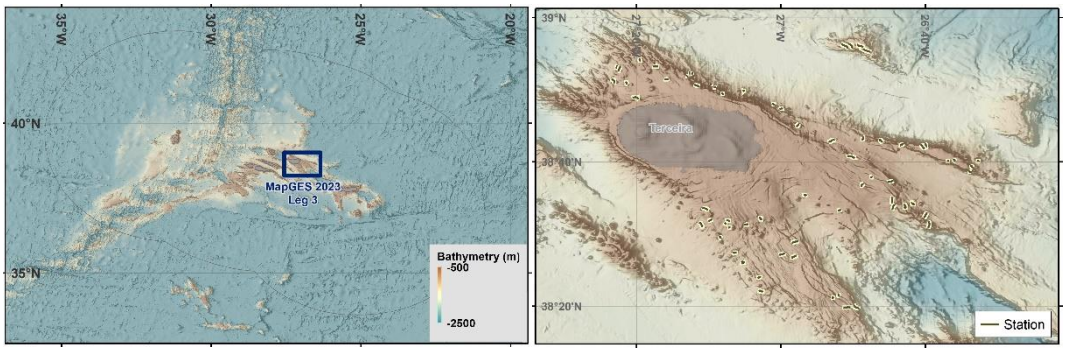


Figure 45. Location of the 67 video transects (black lines) carried out with the Azor drift-cam during Leg 3 of the MapGES 2023 cruise

Figure 46. Screenshots taken from the footage recorded during Leg 3 of MapGES 2023 cruise. (a) Large colonies of *Dentomuricea aff. meteor*. (b) High abundance of what we believe are small primnoid corals, yet to be identified. (c) Several lush colonies of *Leiopathes glaberrima* and *Callogorgia verticillata*. (d) Abundant coral gardens of *Dentomuricea aff. meteor* with *Acanthogorgia* spp. (e) *Haliclona magna* curiously used as refuge by a conger eel (*Conger conger*). (f) One six-gill shark (*Hexanchus griseus*)

1.6.2 Cruise diary of MT Physeter Leg 3

14 July 2023

After a couple of weeks preparing all the necessary gear for conducting two research cruises simultaneously, we arrived to the first day of the MT Physeter Leg 3. We spent the whole morning loading the vessel with the necessary gear and took care of the last logistical aspects. We left Horta harbour at around 13:00, heading towards Praia da Vitória harbour in Terceira Island. We travelled for 4:30 hours under good weather conditions, arriving at around 17:50. We took advantage of the long transit to prepare a new LED light strip to have as backup. After checking everything we would need for the next day, we left the harbour and headed to our rented apartment in the centre of Praia da Vitória. We set our land operational centre in the house and got ready for the next day.

Figure 47. Photo of the first day of the Leg 3 of MapGES 2023 cruise on board MT Physeter

15 July 2023

In the first day of real deep-sea explorations around Terceira Island in 2023, we decided to take advantage of the northern winds to survey an area named Terceira NW. We left the harbour at 08:30 and started to transit towards the northern slopes of the island, under relatively rough sea conditions. This area is composed of a diverse geomorphology with several small ridges, hills, and knolls, at different depths. In general, all dives went smoothly with no major technical issues, but with some challenging drifts during some of the dives. The first dive ended earlier due to a false potential entanglement on a fishing line. The good news of the day was that the new set of Outland lasers worked fine. We conducted 5 dives with the Azor drift-cam, between 800 and 223 m depth, with the first dive of the day starting at 09:45.

The deepest areas explored were characterized by frequent and small aggregations of the glass sponge *Pheronema carpenteri* and occasional demosponges of the species *Macandrewia azorica*. In shallower areas (~500 – 250 m) the benthic communities observed were quite distinct, in particular in the 4th dive of the day, where an impressive assemblage of several species of corals, sponges and mobile fauna dominated the entire dive. Irregular, jagged basaltic outcrops harboured aggregations of *Viminella flagellum* (in particular, its yellow morphotype), many different sponge species (e.g., *Neophrissospongia nolitangere*, *Petrosia crassa)* and fish (*Hoplostenus mediterraneus, Conger conger, Pontinus kuhlii, Phycis phycis*, and a shark *Dalatias licha*). We also drifted over an extensive but partially dead reef of the scleractinian *Eguchipsammia cornigera*, ending the dive by observing an interesting coral garden composed by *Viminella flagellum, Acanthogorgia* spp., *Dentomuricea* aff. *meteor* and large colonies of *Callogorgia verticillata*. Also noteworthy was a large and dense krill swarm spotted in one of the dives at 470m depth, which was attracted to the lights of the Azor drift-cam. It rendered the navigation of the camera almost impossible due to very bad visibility on the live view system. After the last dive we headed towards Angra do Heroísmo harbour to refuel the vessel, arriving at around 20:15.

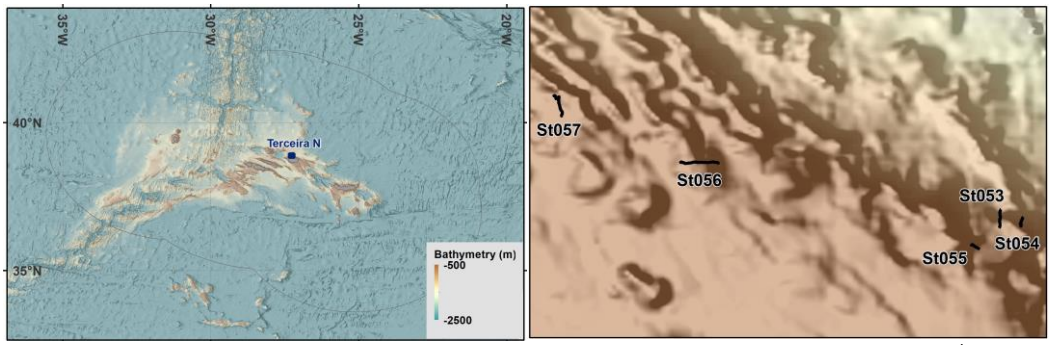


Figure 48. Location of the five dives conducted with the Azor drift-cam in Terceira NW, during the 15th of July 2023

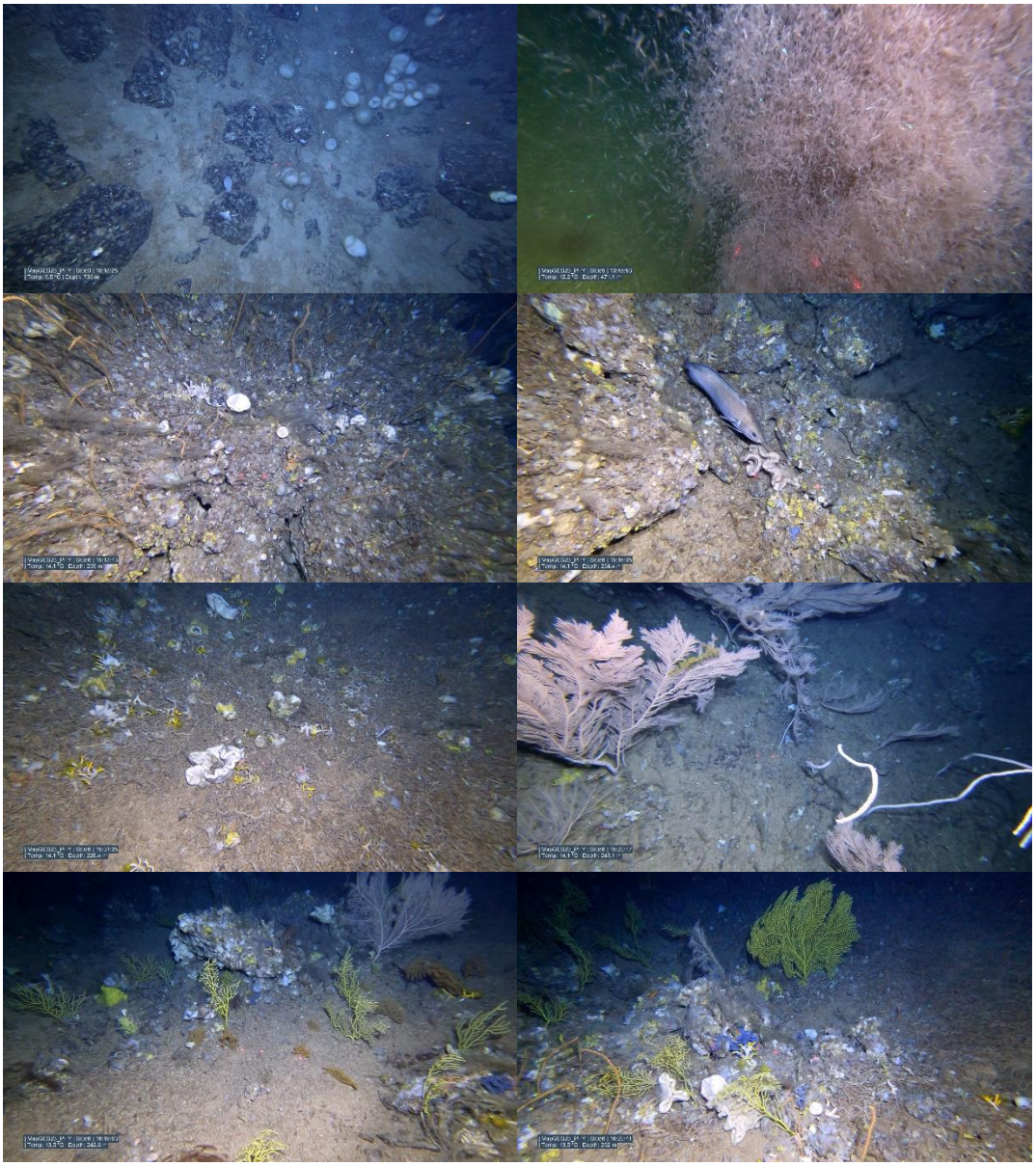


Figure 49. Screenshots extracted from the video footage recorded with the Azor drift-cam in Terceira N, during the 15th of July 2023

16 July 2023

The vessel took a bit longer than expected to refuel and we left Angra do Heroísmo harbour only around 08:45. In the second day of deep-sea explorations around Terceira Island in 2023, we kept the plan of taking advantage of the northern winds and went towards the same area of the previous day in Terceira NW. The wind picked up slightly over the day, but we managed to conduct 4 successful dives and one with a bad drift going down the slope, between 265 and 918 m depth. After the first dive, we discovered that the new Outland lasers got flooded. This is the 4th out of 7 lasers that had serious technical issues. We have been in contact with the company to discuss the problem but haven't yet found a solution. We changed to a new pair of lasers with two c-clips on dive 3 and hopped for the best.

In terms of benthic fauna observed, this was a very interesting day, with a number of different communities present. The deepest area explored was characterized by an assemblage of gorgonian corals of the species *Acanthogorgia* spp. and *Pleurocorallium johnsoni,* together with several glass sponges (e.g., *Pheronema carpenteri, Farrea occa, Regadrella phoenix).* In shallower areas, we drifted over impressive communities that were alternately dominated by sponges such as the laminate *Poecillastra compressa,* and several cnidaria species: *Viminella flagellum, Callogorgia verticillata*, *Dentomuricea* aff. *meteor, Errina dabneyi, Elatopathes abietina* and occasional aggregations of large colonies of *Acanthogorgia* spp. The large size attained by most of the *Callogorgia verticillata* colonies observed was also noteworthy. Similarly to the previous day, we were also surrounded by yet another large krill swarm, this time actually being preyed on by a school of *Trachurus picturatus,* which "escorted" our camera system for a long time. We also briefly saw a large ray *Dipturus intermedius.*

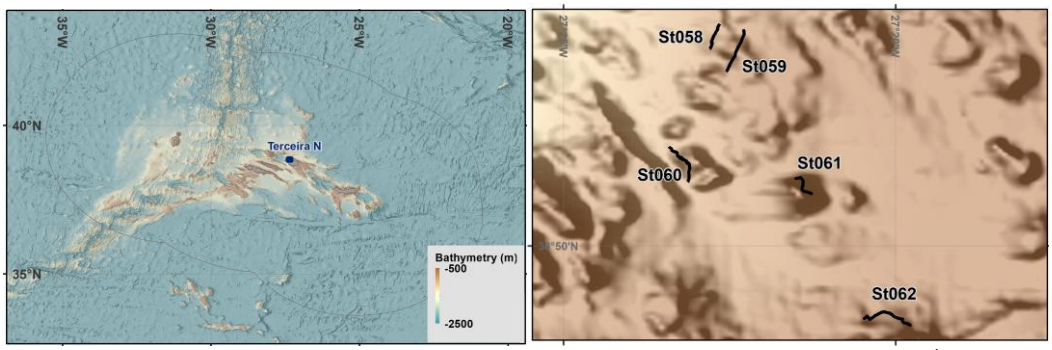


Figure 50. Location of the 5 dives conducted with the Azor drift-cam in Terceira NW, during the 16th of July 2023

Figure 51. Screenshots extracted from the video footage recorded with the Azor drift-cam in Terceira N, during the 16th of July 2023

17 July 2023

The weather forecast suggested the prevailing winds were still coming from the North and, therefore, decided to continue working in the Terceira N area. However, this was a challenging day with bad drifts, no drifts at all, or aborted dives because of the lack of drift. Nevertheless, we conducted 5 dives between 191 and 1006 m depth. The first 2 dives were quite bare in terms of benthic fauna, while navigating the camera system along the seafloor was not easy due to bad drifts. On the 3rd dive of the day, we got stuck on an overhanging rock but we managed to successfully release the Azor drift-cam with no damage.

The biodiversity observed in this dive (St065) was a bit richer, with large whip corals *Viminella flagellum* colonizing large basaltic ouctrops, while the 5th dive (St067) was characterized by small aggregations of *Acanthogorgia* spp, where we also drifted over many fish species (e.g., *Conger conger, Helicolenus dactylopterus, Phycis phycis*) in amongst several lost fishing lines and bottom longlines. However, the clear highlight of the day came in the last dive (St068), performed between 300 and 200 m depth. Most of the seafloor explored was colonized by a vast coral garden composed of *Viminella flagellum, Acanthogorgia* spp., *Callogorgia verticillata* and clearly dominated by *Dentomuricea* aff. *meteor.* What was truly striking about this dive was the density and size achieved by the colonies of *Dentomuricea* aff. *meteor*, quite possibly the largest specimens we have recorded so far in the Azores region. Moreover, the large extent of this coral garden was truly remarkable, being present for most of the ~650 m of seafloor explored. Most of the colonies seemed to be in a good condition but some were rather impacted.

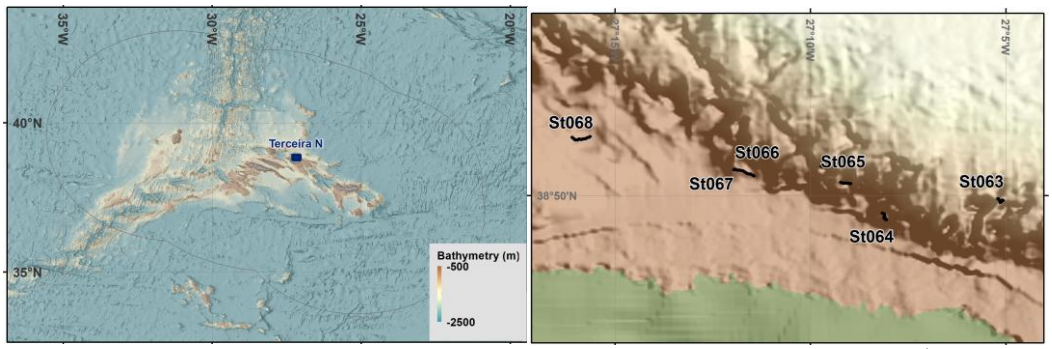


Figure 52. Location of the six dives conducted with the Azor drift-cam in Terceira N, during the 17th of July 2023

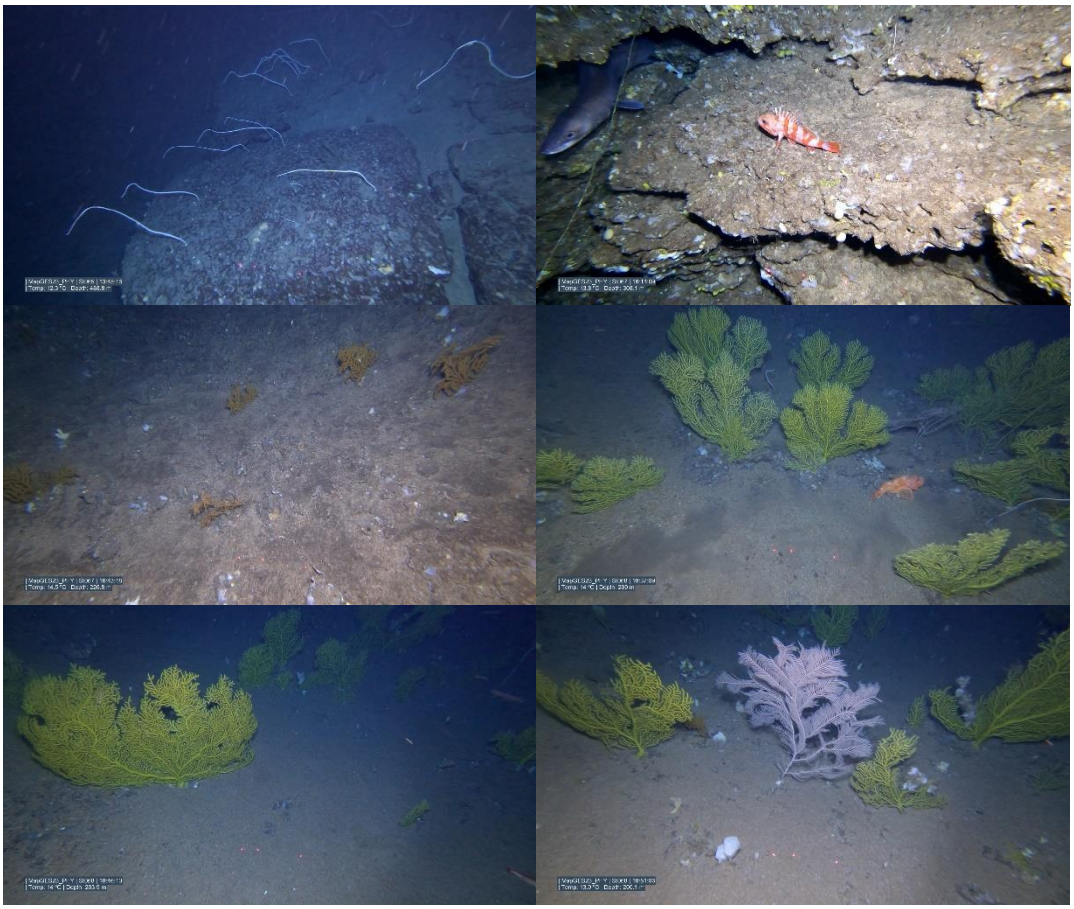


Figure 53. Screenshots extracted from the video footage recorded with the Azor drift-cam in Terceira N and NE, during the 17th of July 2023

18 July 2023

We exited the Praia da Vitória harbour and headed towards the vast Terceira E area, starting the first dive at around 09:30. The 5 dives of the day were conducted between 340 and 950 m depth. After scraping the Azor drift-cam on vertical walls during dive St070 and St073 at 400 and 500m depth, some technical repairs were required. Some sections of the cable had lost the duct tape that joined together the electric and nautical cable, an issue swiftly amended. Additionally, the Gitup and concentric lights casings were slightly moved, needing some small adjustments to be back to their correct angles. This was a particularly impressive day in terms of benthic fauna recorded.

Similarly to the previous day, we spotted a large coral garden of *Viminella flagellum, Acanthogorgia* spp., *Callogorgia verticillata*, *Dentomuricea* aff. *meteor*, *Paracalyptrophora josephinae* and the black coral *Leiopathes glaberrima*, while the sponge assemblage was also quite interesting. Large specimens of the *Characella pachastrelloides* complex seen colonizing basaltic substrate in one dive, among other species such as *Neophrissospongia nolitangere*, *Phakellia ventilabrum, Poecillastra compressa Macandrewia azorica, Haliclona implexa* and including an aggregation of *Stylocordilla pellita.* During the deepest dive, small aggregations of cf. *Candidella imbricata* were seen covering the seafloor. The last dive of the day was characterized by several lush colonies of *Leiopathes glaberrima* (most of which entangled by lost bottom longlines), concomitantly covering the seafloor with *Callogorgia verticillata*, *Dentomuricea* aff. *meteor,* cf. *Candidella imbricata* and some colonies of *Enallopsammia rostrata*. The seafloor was also abundantly covered by what we believe to be small primnoid corals, yet to be identified. We transited back to harbour and arrived in Praia da Vitória at around 19:30.

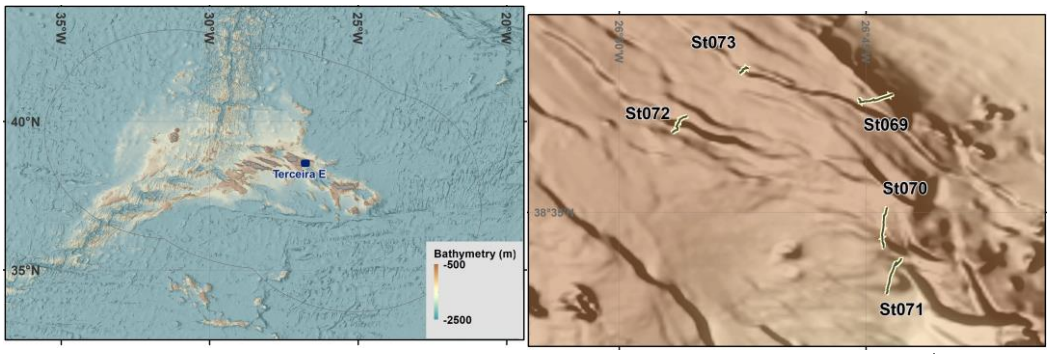


Figure 54. Location of the five dives conducted with the Azor drift-cam in Terceira E, during the 18th of July 2023

Figure 55. Screenshots extracted from the video footage recorded with the Azor drift-cam in Terceira E, during the 18th of July 2023

19 July 2023

Due to logistic problems in Praia da Vitória, we had to refuel the MT Physeter in Angra do Heroísmo marina. We left the harbour at around 10:00 and headed to the small hills just outside Monte Brasil. The sea was really flat but the breeze, the tidal currents and the skipper´s skills made the drifts of the day very successful. We conducted five dives in the Terceira South area from 260 to 920 m depth.

Most of the dives drifted over soft bottoms but the first dive of the day revealed thriving benthic communities, with impressively abundant coral gardens of *Dentomuricea* aff. *meteor, Callogorgia verticillata, Viminella flagellum, Paracalyptrophora josephinae* and particularly lush colonies of *Acanthogorgia* spp. We also spotted many lost fishing lines and bottom longlines, entangling some corals. As we drifted along a vertical wall, we marvelled at how it was densely colonized by large corals of the species cf. *Candidella imbricata*, *Acanthogorgia* spp. and *Dentomuricea* aff. *meteor.* Despite this, most of the colonies observed seemed to be healthy. Upon reaching the top of this hill, we drifted over a vast reef of the scleractinian *Eguchipsammia cornigera.* The

deepest dive of the day was characterized by a mixed substrate occasionally inhabited by the glass sponge *Pheronema carpenteri,* the primnoid corals *Narella versluysi, Narella bellissima* and possibly a couple of colonies of *Paragorgia johnsoni.* Large, funnel-shaped sponges of the *Characella pachastrelloides* complex and many smaller sponges colonized most of the shallower seafloor explored. In terms of mobile fauna, many fish species were seen exploring the dense coral gardens, such as *Hoplostethus mediterraneus* and *Pontinus kuhlii.* We also encountered an alfosino (*Beryx decadactylus*) and scared off a skittish angler fish (*Lophius piscatorius*) as the weight of the camera system heavily hit the ground. On the second dive of the day, some water leaked into the Git-Up housing damaging the camera. We finished the day in Praia marina at around 20:45.

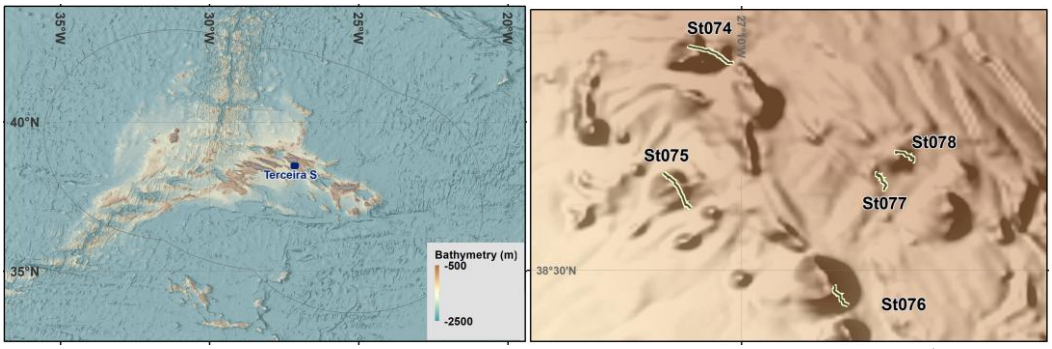


Figure 56. Location of the five dives conducted with the Azor drift-cam in Terceira S, during the 19th of July 2023

Figure 57. Screenshots extracted from the video footage recorded with the Azor drift-cam in Terceira S, during the 19th of July 2023

20 July 2023

Today, we headed to the eastern tip of the Maçarico area, 23 nm East of Praia da Victória. As in some of the previous days, it was quite challenging due to the bad or no drifts. We tried everything we could to make to MT Physeter move with the Azor drift-cam, but that proved to be almost impossible. As a summary of the day, we performed 5 dives with almost no drift and covered only 1.9 km of seafloor. In the first dive of the day, the Git-up housing flooded again, and we lost one of the new cameras (just had made a couple of dives), one battery, one memory card, and the connection cables. Since this was the second time that happened with the same housing, we changed the housing and tried to clean it and change the O-rings of the flooded one. We also changed to another new Git-up camera. On the last dive of the day, in a shallower area, we got stuck on a fishing line as soon as we hit the seafloor. After a couple of tries and moving the MT Physeter on the opposite direction, we managed to get free and recover the Azor drift-cam with no damages, with the exception of a lost weight.

Although the drifts were quite poor, this area seemed to have a suitable seabed for hosting benthic megafauna conditions. We will try to revisit the eastern end of Maçarico on another occasion. Nevertheless, we spotted interesting aggregations of the sponge *Asconema fristedti*, on a couple of occasions reaching considerably high densities. Within these aggregations, some coral species were also found, such as small *Pleurocorallium johnsoni*, *Callogorgia verticillata, Paracalyptrophora josephinae* and *Viminella flagellum*, with the latter being an uncommon community composition. Apart from *Asconema fristedti,* other sponge species were present as well, such as large *Characella pachastrelloides* complex sponges and *Haliclona magna*, the lamellate *Poecillastra compressa* and *Desmacella grimaldi,* and sponges of the genus Geodia. Despite the small amount of time, we spent surveying the seafloor on the last dive, we also observed an aggregation of large colonies of *Viminella flagellum,* right before we got stuck on the fishing line. Several bluemouth rockfish *Helicolenus dactylopterus* and conger eel *Conger conger* were also seen. We finished the day at Praia da Victória harbour at around 20:00 and did a quick cleaning of the MT Physeter.

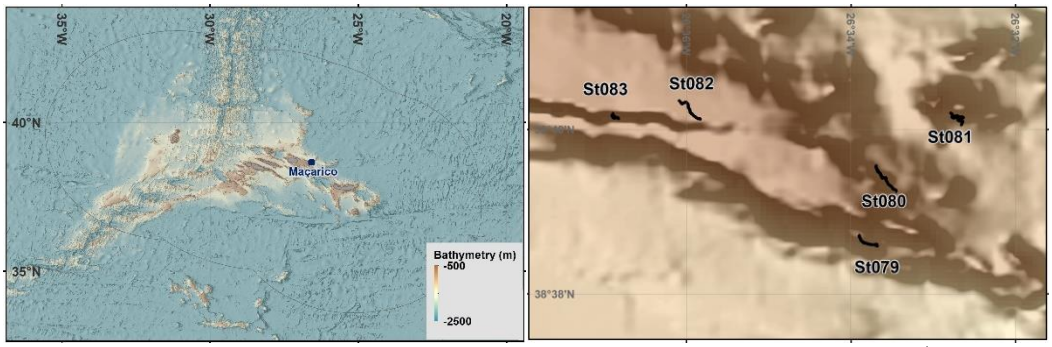


Figure 58. Location of the five dives conducted with the Azor drift-cam in Maçarico, during the 20th of July 2023

Figure 59. Screenshots extracted from the video footage recorded with the Azor drift-cam in Maçarico, during the 20th of July 2023

21 July 2023

Today, we received the visit of a filming crew from the Portuguese National TV channel (RTP) show "Biosfera". They were interested in knowing more about how cost-effective deep-sea exploration can help understanding the potential impacts of deep-sea mining in the Azores. They had the chance to interview Telmo Morato and listen to João Balsa explaining the different components of the Azor drift-cam. We left Praia da Victória harbour at around 8:15 after making a shoot of the MT Physeter departure from the local marina. We headed to a small seamount located 15 nm NE of Praia, named Álvaro Martins. This seamount has a flat plateau at around 650m depth with gentle to steep slopes on the northern and southern sides of the structure. Unexpectedly, we experienced one of the best days of drifting conditions ever, that allowed us to cover about 4 km of the seafloor and obtain 6 hours of images of the seafloor. Because of the perfect drifts, we made 4 long dives between 680 and 1,000m depth.

Most of the slopes and top of the seamount were covered by soft sediments but in plateau revealed some interesting benthic megafaunal communities. These were for the most part composed by *Narella versluysi* and *Narella bellissima,* frequently in high densities and covering large extensions of the seafloor. Some stylasterids and bamboo corals from the species *Acanella arbuscula* were also a part of the landscape, as well as occasional glass sponges such as *Regadrella phoenix* and *Pheronema carpenteri.* A small highlight that reserves to be mentioned is the basalt rock we drifted over, covered in large colonies of the black coral *Leiopathes expansa*, which were harbouring a couple of decapoda *Sternostylus formosus*. We had no technical issues during the day apart from the electric cable being stuck on the winch for a couple of times but with no loss of the live-view

signal quality. On the way back to marina da Praia, we encountered a group of about 15 beaked whales. We finished the day in Praia at around 20:45 but the MT Physeter crew headed to Angra do Heroísmo to refuel in the next morning.

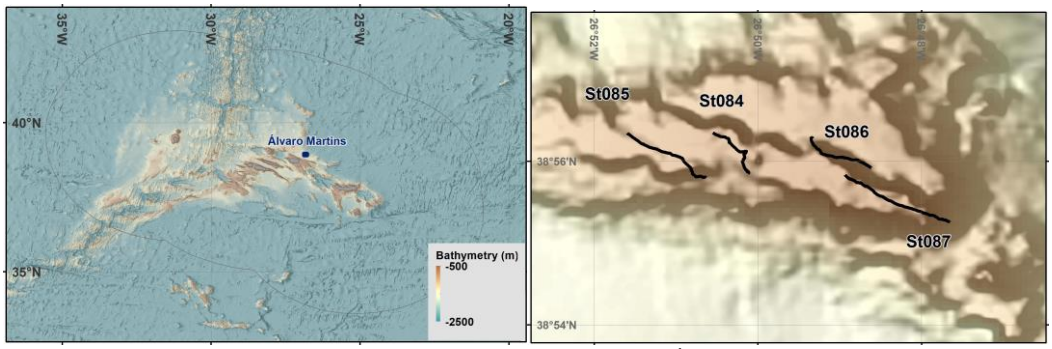


Figure 60. Location of the four dives conducted with the Azor drift-cam in Álvaro Martins, during the 21st of July 2023

Figure 61. Screenshots extracted from the video footage recorded with the Azor drift-cam in Álvaro Martins seamount, during the 21st of July 2023

22 July 2023

After refuelling and putting some extra water in the tanks of the MT Physeter, we left Angra do Heroísmo marina at around 9:00. We transited to the Eastern tip of an area named Gastromar, which is located 20 nm south-eastern of Terceira Island. The sea was very calm with only a light breeze blowing from the SE. The first two

drifts of the day were slow but lasted long and covered a linear distance of about 800m each. The last two dives of the day were very challenging due to the poor drift of the Azor drift-cam. In fact, the third dive was aborted while the last dive of the day covered only about 400m. We mostly explored soft bottoms with some rocky outcrops between 560 m and 1050 m depth, with no technical issues. We encountered diverse faunal assemblages, from communities dominated by *Narella versluysi* and *Narella bellissima*, to ones composed of more sparse colonies such as *Acanella arbuscula*, cf. *Crypthelia* sp., *Leiopathes expansa* and *Chrysogorgia sp.* As the definitive highlight of the day, we drifted over an extensive and abundant aggregation of *Placogorgia* complex colonies, small soft-corals of the genus *Pseudoanthomathus* and dense *Pleurocorallium johnsoni* patches, possibly associated with several small and medium sized colonies of white *Paragorgia johnsoni* and its red morphotype as well. Regarding the sponge assemblage, we identified several different species colonizing the seafloor. From larger and more occasional species such as *Haliclona magna,* to *Pheronema carpenteri* and *Macandrewia azorica* dominated areas. Hexatinellids such as *Poecillastra compressa* and *Regadrella phoenix* were also observed. In terms of mobile fauna, we only identified a small shoal of *Hoplosthenus mediterraneus* and other more solitary fishes such as *Conger conger, Mora morro* and *Beryx splendens* After the last dive, we went back to Praia da Victória and said goodbye to the skipper Bruno and to Gerald.

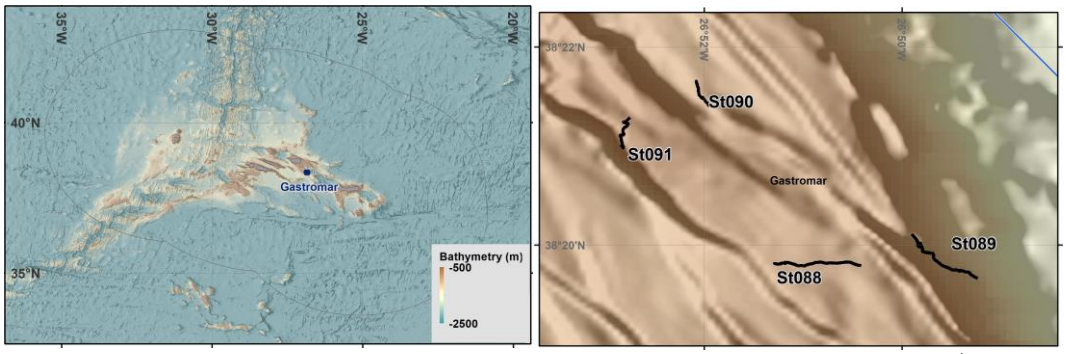


Figure 62. Location of the four dives conducted with the Azor drift-cam in Gastromar, during the 23rd of July 2023

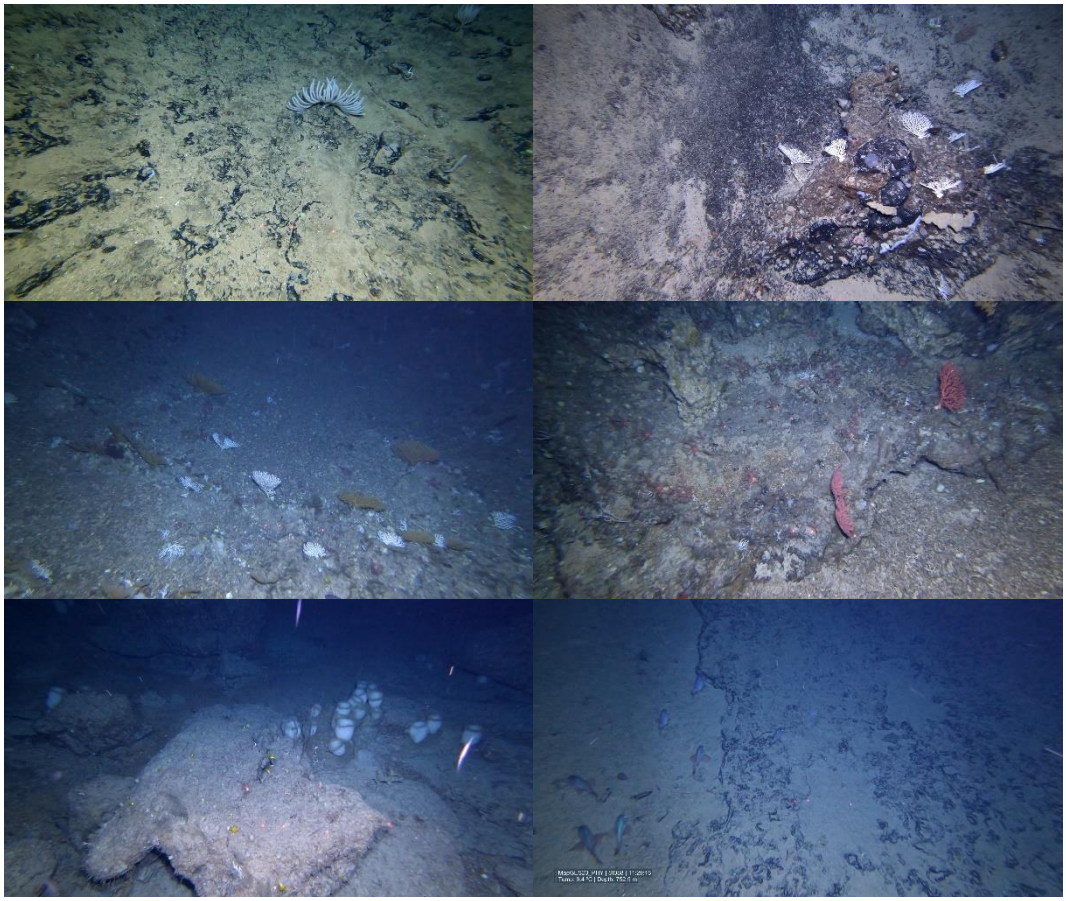


Figure 63. Screenshots extracted from the video footage recorded with the Azor drift-cam in Gastromar, during the 22nd of July 2023

23 July 2023

This was the last day at the sea for part of the scientific crew. Early in the morning the new elements of the scientific team (Luís Rodrigues -chief scientist-, Inês Carneiro, Inês Bruno and Isabel Areosa) landed in Terceira airport and got settled for the coming days. We also welcomed Sisenando, the MT Physeter skipper that would lead us in the rest of this Leg. We left Praia da Victória harbour at around 8:30 and headed East towards Maçarico area. We worked a bit closer to shore to ease the transfer of command to the new team, by arriving back to harbour a little earlier. We were able to conduct 4 dives between 500 m and 900 m depth. In the first dive, we descended a long and steep slope with the camera system going backwards but facing the rocks. We believe that this dive could still be useful for annotation. The other 3 dives were performed under moderately good drifts and navigations and covered a large extent of rocky bottoms.

Several soft coral species were found densely colonizing vast extensions of the mentioned steep slope, with large colonies of *Callogorgia verticillata* and some hydrozoans also observed. Furthermore, *Acanthogorgia* spp. and *Pleurocorallium johnsoni* were also found composing this community. Long colonies of the whip coral *Viminella flagellum* were also observed together with many glass sponges of the species *Asconema fristedti*. The sponge assemblage was also quite diverse, with big specimens belonging to the genus *Characella* and *Geodia*, hexactinelids such as *Poecillastra compressa* and large individuals of the species *Haliclona magna*. On one occasion, this latter was spotted being curiously used as refuge by a conger eel (*Conger conger*). We also drifted over a few *Dalatias licha,* a ~2.3m long "false catshark" (*Pseudotriakis microdon)* and other fishes such as *Trachyscorpia cristulata* and *Hoplostenus mediterraneus*. We interrupted the last dive before reaching the

top of the geomorphological structure and transited back to Praia da Victória. We were welcomed by the new scientific team and reassigned the command. We had dinner together at a local restaurant Casa de Pasto.

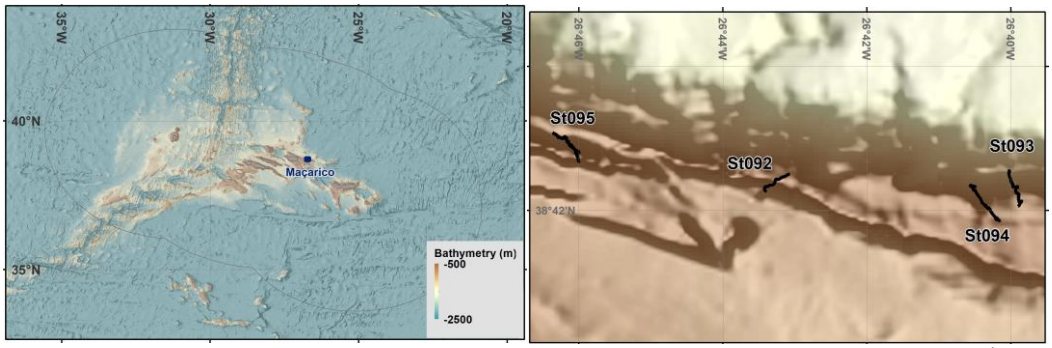


Figure 64. Location of the four dives conducted with the Azor drift-cam in Maçarico area, during the 23rd of July 2023

Figure 65. Screenshots extracted from the video footage recorded with the Azor drift-cam in Maçarico area, during the 23rd of July 2023

24 July 2023

Early in the morning, the MT Physeter crew headed to Angra do Heroísmo marina for refuelling. Today, the police officer was only available at 09:15, which delayed our departure to the first station. On the first day of the new scientific team, around 9:30, we left Angra do Heroísmo harbour heading to Terceira S, where we arrived at about 10:31. The sea was mostly calm, with only a mild breeze and the dives were conducted from 500 m to 850 m depth. Possibly due to the tide changes, the first two drifts of the day were slow and variable,

rendering the navigation very difficult. The first dive was interrupted due to the poor drift and the fact that the Azor drift-cam was moving backwards. We tried to manoeuvre the MT Physeter to better direct the drift but with no success. The weight was replaced in the second dive by mere technical option. The afternoon dives improved a bit, also with the help of the skipper, but navigation was still a challenging task, because the structure tended to come up too high from the bottom. During the recovery of the structure to the surface on the third dive, one of the float cables broke and was repaired promptly. We had our best drift during the last dive of the day, being still unable to reach the top of the seamount but covering a good part of the side of it.

All dives showed sandy substrates with some sedimentary or basaltic outcrops and boulders, and occasional small vertical walls and during the fourth dive (St099) we saw some coral rubble. The dives were not particularly rich in terms of benthic fauna; however, we observed some aggregations of *Viminella flagellum (*particularly in St100*),* some colonies of *Callogorgia verticillata, Elatopathes abietina* and *Pleurocorallium johnsoni.* On the deepest dives we spotted some black corals from the species *Parantipathes hirondelle,* the bamboo coral *Acanella arbuscula,* and some stylasterids as well as some small agreggations of *Narella versluysi* and *N. bellissima*, mostly at the basaltic outcrops. *Leiopathes expansa* was also spotted with *Sternostylus formosus* associated. In addition to various small encrusting sponges, this group was mainly composed by the presence of ocasional specimens of *Characella pachastrelloides* complex, *Petrosia crassa*, *Farrea occa*, *Macandrewia azorica*, *Regadrella phoenix*, *Neophrisopongia nolitangere*, *Stylocordila pellita* and *Phakellia ventilabrum* and some small aggregations of *Phakelia robusta* colonizing coral rubble. The mobile fauna present included *Chaunax pictus*, *Helicolenus dactylopterus* and one *Dipturus intermedius* spotted at the first dive of the day. We arrived at Praia da Vitória harbour at around 20:20, leaving all gear cleaned and prepared for the next day.

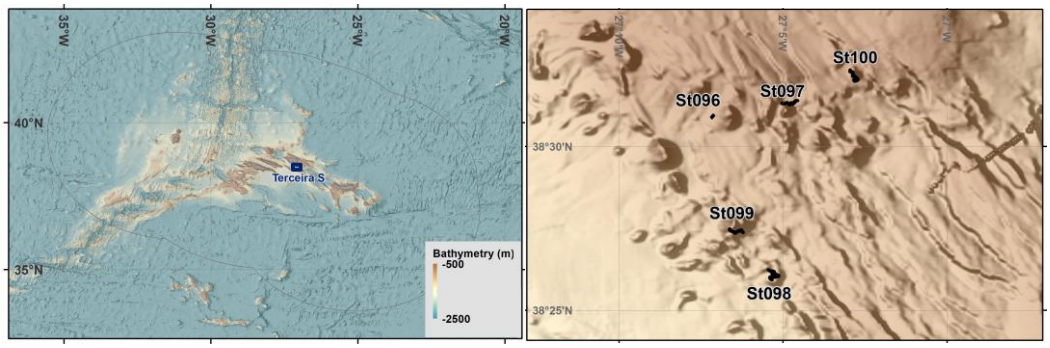


Figure 66. Location of the five dives conducted with the Azor drift-cam in Terceira S, during the 24th of July 2023

Figure 67. Screenshots extracted from the video footage recorded with the Azor drift-cam in Terceira S, during the 24th of July 2023

25 July 2023

On one more day in our journey of deep-sea exploration, we left Praia da Vitória harbour at approximately 8:20, in direction to Beirada de Fora, SE Terceira Island, where we arrived at around 9:44. Already aware of the inherent risk of the area due to fishing activities, we got entangled on a fishing line during the first dive. Fortunately, and with the dexterity of the team members and the skipper, we managed to recover the structure with no considerable damage, having only lost the weight. We performed 5 dives during the day. The first dives of the day were performed under good wind conditions that allowed for good drifts and navigations. Because of the wind change during the afternoon, the last two dives (St104 and St105) were more challenging mainly in terms of navigation. The geomorphology of the bottom was diverse varying from sandy to rocky grounds and even coral rubble. Regarding the observed benthic fauna, it was during the first dive that we found the large aggregations of *Viminella flagellum,* possibly the highlight of the day, together with some casual colonies of *Paracalyptrophora josephinae.* We also observed small aggregations of *Lytocarpia myriophyllum* during this dive. Throughout the following dives we also identified *Narella belissima* and *N. versluysi, Acanthogorgia* spp., *Pleurocorallium johnsoni* and two species of black corals – *Parantipathes hirondelle* and *Elatopathes abietina*. The sponges observed were mainly *Characella pachastrelloides, Pheronema carpenteri, Petrosia crassa, Phakelia ventillabrum, Farrea occa* and *Geodia* sp. On sandy bottoms we also noticed *Macandrewia azorica, Stylocordila pellita* and *Leiodermatium* sp. Mobile fauna was characterized by the presence of *Chaunax pictus* and *Helicolenus dactylopterus*. The day finished at 19:20 in Praia da Vitória harbour.

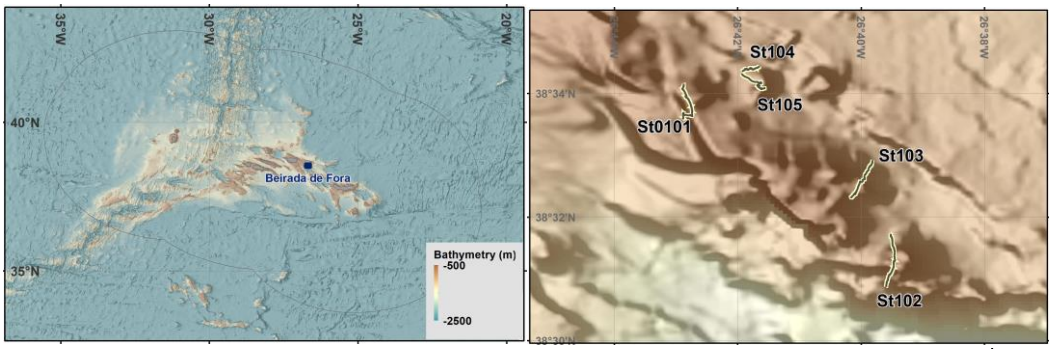


Figure 68. Location of the five dives conducted with the Azor drift-cam in Beirada de fora, during the 25th of July 2023

Figure 69. Screenshots extracted from the video footage recorded with the Azor drift-cam in Beirada de fora, during the 25th of July 2023

26 July 2023

We left Praia da Vitória heading to Angra do Heroísmo harbour, where we arrived at 9:20, to meet the MT Physeter team who was refueling the boat. We began our transit to Gastromar area at approximately 9:45 and arrived at the first station at around 11:10. While closing the waterproof case a screw broke inside one of the threads, but we were able to remove it and continue the normal procedures to deploy the Azor drif-cam. Just as two days previous, the sea conditions were not the best to achieve a good drift and so, the first two dives were not easy to navigate the system, with the structure turning around itself. The last dive of the day was by far the best one regarding drift and navigation. During the preparation for the third dive, while closing the lasers and led strip battery case, a spark was detected inside it, which may have been caused by the rupture of one of

the electric cables. One of the sets of 4 pins stopped working and was immediately replaced with one from another structure. The broken one was taken to land for further analysis of the damage. The dive sites were mainly characterized by sandy bottoms with some sporadic basaltic boulders, coral rubble and basaltic outcrops. There was some common fauna between the first and last dive such as *Acanthogorgia* spp., *Narella bellissima*, *N. versluysi* and *Pleurocorallium johnsoni*. During the second dive both species of the genus *Narella* appeared together again, in small aggregations.

The most common sponge species was *Pheronema carpenteri*, with big aggregations spotted on the last dive (St108). Other glass sponges such as *Farrea occa*, *Phakelia ventillabrum* and cf. *P. robusta* were also present, with the latter appearing in high densities, specifically during the first dive. Regarding mobile fauna, an appearance of the deep-sea shark *Dalathias licha* was recorded. The day ended in Praia da Vitória harbor where we arrived at 19:30 after a smooth trip in which we were presented with the visit of some curious dolphins that escorted the boat for a while.

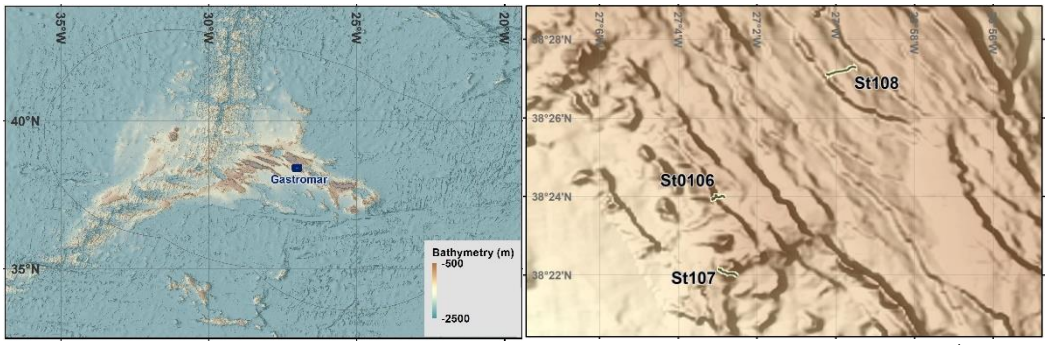


Figure 70. Location of the three dives conducted with the Azor drift-cam in Gastromar, during the 26th of July 2023

Figure 71. Screenshots extracted from the video footage recorded with the Azor drift-cam in Gastromar, during the 26th of July 2023

27 July 2023

Early in the morning, we left João Balsa on land so he could go back to Faial. We left Praia da Vitória harbour around 8:20 heading to Terceira NE area. All three dives of the day were characterized by basaltic bottoms with some sand. The first dive and the last were both shallower, with depths between 490m and 680m, while the second dive was performed at around 800m. Both first and last dives were very similar in terms of benthic fauna with some aggregations of *Viminella flagellum* (particularly extensive on the last dive), we also observed some dense patches of *Acanthogorgia* spp. and *Pleurocorallium johnsoni* together with the soft coral of the genus *Pseudoanthomastus*. Some glass sponges such as *Farrea occa* and larger demosponges like *Geodia* sp., *Petrosia crassa*, *Desmacella grimaldi* and *Characella pachastrelloides* complex were also observed on both dives. The deepest areas explored had some octocorals from the species *Narella versluysi* and *Acanthogorgia* spp., as well as the cup coral *Leptopsammia formosa*. Regarding sponge assemblage, it was mainly composed of smaller glass sponges such as *Farrea occa* and *Aphrocallistes beatrix* complex. Regarding mobile fauna we spotted several bluemouth rockfish (*Helicolenus dactylopterus*), one monkfish (*Lophius piscatorius*) and one six-gill shark (*Hexanchus griseus*). During this dive the Azor drift-cam navigation was difficult. The camera almost stopped moving, and it was only after recovering around 30 m of cable that we noticed we were actually stuck on a vertical wall, having managed to successfully release the equipment.

The fieldwork day ended earlier. After the third dive of the day, the scientific chief together with the skipper decided to get back to land due to the increased wind and swell, which rendered operations with the Azor drift-cam much more difficult and unsafe. We arrived in Praia da Vitória harbor at 14:50.

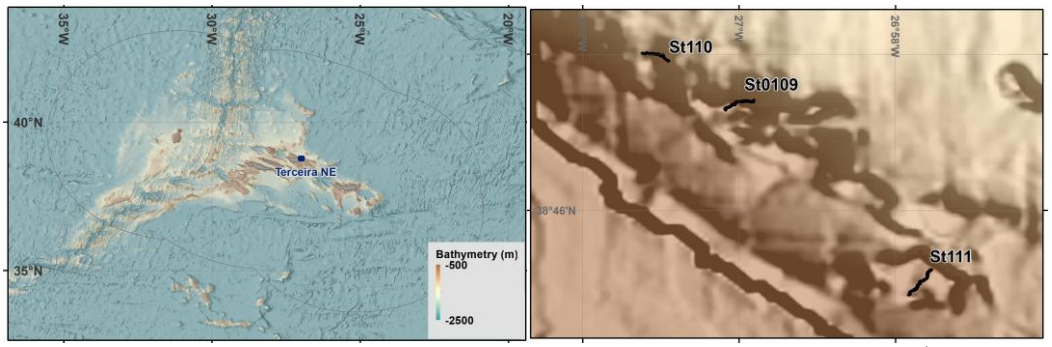


Figure 72. Location of the 3 dives conducted with the Azor drift-cam in Terceira NE, during the 27th of July 2023

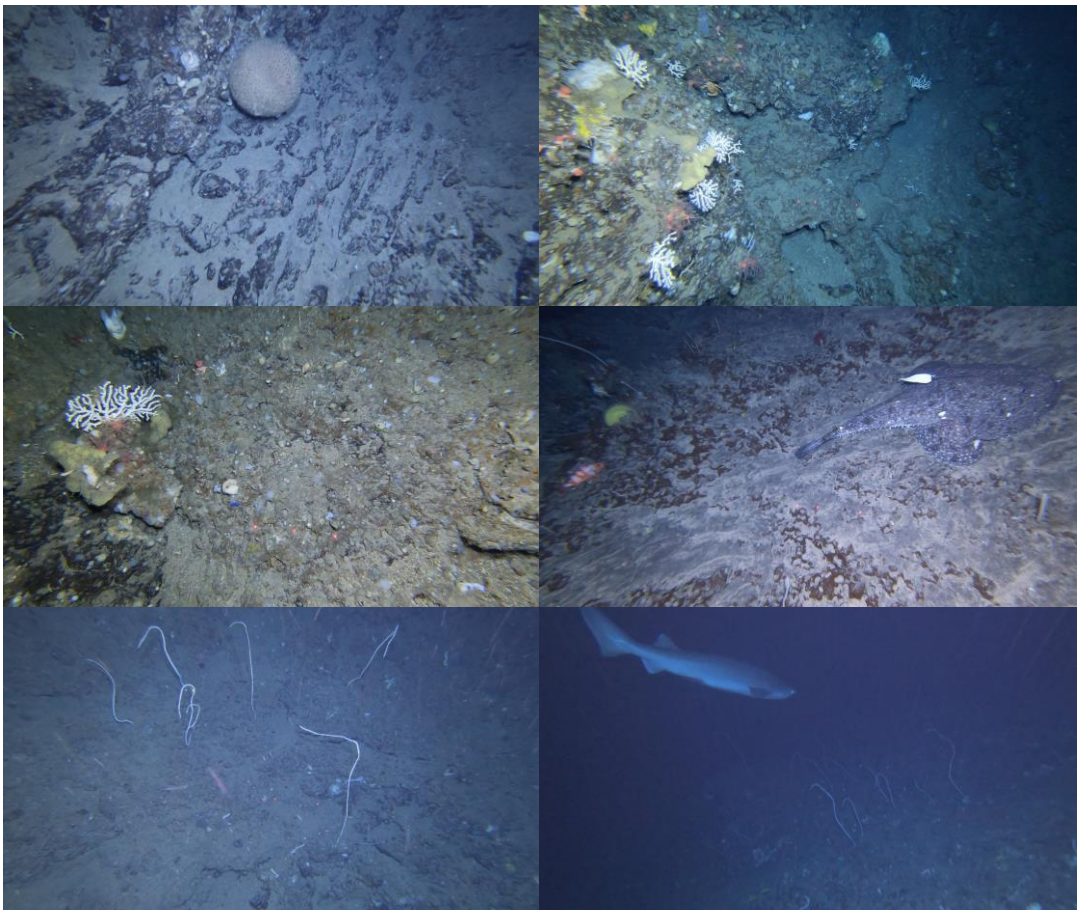


Figure 73. Screenshots extracted from the video footage recorded with the Azor drift-cam in Terceira NE, during the 27th of July 2023

28 July 2023

We left Praia da Vitória around 8:30 and decided to go back to Terceira E to continue exploring its seamounts. We arrived at the first station at 09:02, however, the drift was very strong and to avoid going down a big slope we decided to move to another seamount 2 nm away. The first dive started at 09:28. The first two dives were both performed at depths below 600m, the second one being shallower. The drift was perfect to navigate the camera along the top of the seamounts which helped us collect impressive images of the benthic fauna present. Similarly to what happened on the 18th of July, around the same area, these first two dives were remarkable in terms of the fauna recorded, especially the second one. We spotted large coral gardens of *Viminella flagellum*;

small aggregations of *Acanthogorgia* spp., *Dentomuricea* aff. *meteor* and *Enallopsammia rostrata*, sparse *Callogorgia verticillata*, *Parantipathes hirondelle*, and some colonies of the endemic cf. *Errina dabneyi*. *Paracalyptrophora josephinae* was common during the first dive, while in the second dive we found several lush colonies of *Leiopathes glaberrima* and a high abundance of what we believe are the same small primnoid corals recorded on the 18th of July yet to be identified. The sponge assemblage was also interesting: large specimens of the *Characella pachastrelloides* complex seen colonizing basaltic substrate, among other species such as *Geodia* sp., *Leiodermatium* both its white and blue morphotypes *Neophrissospongia nolitangere*, *Macandrewia azorica*, *Petrosia crassa*, *Haliclona magna* and small aggregations of *Xestospongia variabilis*. In terms of mobile fauna, during these two dives we observed some fishes from the species *Helicolenus dactylopterus*, *Lophius piscatorius* and *Lepidorhombus whiffiagonis*; one ray *Dipturus intermedius*, and two six-gill shark *Hexanchus griseus*. We also spotted two different species of crabs: *Cancer bellianus* and *Paramola cuvieri*. During the two first dives we found a lot of lost bottom longlines entangled in some corals.

For the last dive we moved to Maçarico area, however the dive was very short (00:11:02). After arriving to the bottom, it was clear that the wind at the surface was too strong, dragging the drift cam, and we felt that the conditions were not the best to continue the dive, so we canceled it and headed back to shore. We arrived in Praia da Vitoria at 15:19.

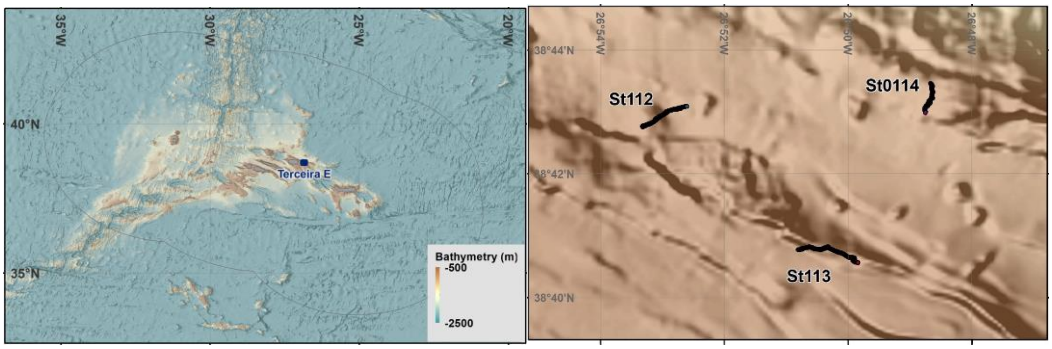


Figure 74. Location of the three dives conducted with the Azor drift-cam in Terceira E and Maçarico, during the 28th of July 2023

Figure 75. Screenshots extracted from the video footage recorded with the Azor drift-cam in Terceira N, during the 28th of July 2023

29 July 2023

The team met with MT Physeter in Angra do Heroísmo harbour. The vessel took a bit longer than expected to refuel and we only left the harbour at around 08:45. We performed 4 dives during this day, first two in Gastromar area (between 620-740m) and the last two in Terceira E (between 370- 660m). Both dives in Gastromar were performed at very similar depths, with both being characterized by sandy bottoms with basaltic outcrops, and the benthic fauna observed was very similar as well. The highlight of both dives were the large *Pheronema carpenteri* aggregations, especially in the second dive. Along with the bird's nest sponge, we observed other hexactinelids such as *Farrea occa* and larger sponges such as *Macandrewia azorica*, *Characella connectens* and *Characella pachastrelloides* complex. In terms of corals, we recorded some occasional *Acanthogorgia spp.*, *Pleurocorallium johnsoni* and the black coral *Parantipathes hirondelle*. Regarding the last two dives, the shallower one (St117) showed some *Viminella flagellum* aggregations associated with *Acanthogorgia spp.*, *Elatopathes abietina* and *Enallopsammia_rostrata*. The last dive was especially interesting showing an extensive aggregation of the white morphotype of *Paragorgia johnsoni* with at least one red morphotype of *Paragorgia johnsoni*. Regarding sponges, during both dives we observed: individuals from the complex *Characella pachastrelloides*, *Neophrissospongia nolitangere*, *Leiodermatium* sp. and *Desmacella grimaldi*. During the day we also spotted the deep-sea shark *Dalatias licha*, some *Helicolenus dactylopterus*, a school of *Hoplostenus mediterraneus* and some decapodes as well (*Paramola cuvieri* and *Bathynectes maravigna*). After watching the last videos, we noticed a lot of lost fishing longlines in all the dives of the day,

that we fortunately managed to avoid. We arrived at Praia da Vitória at 19:30 and started organizing everything on land to leave Terceira the day after.

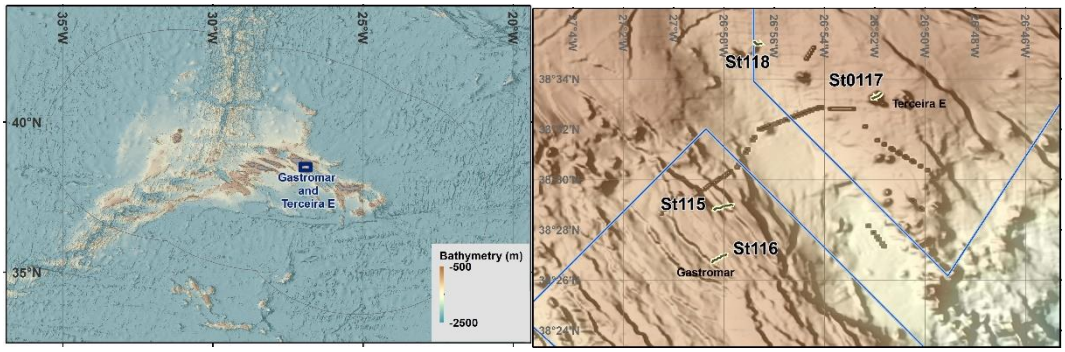


Figure 76. Location of the four dives conducted with the Azor drift-cam in Gastromar and Terceira E, during the 29th of July 2023

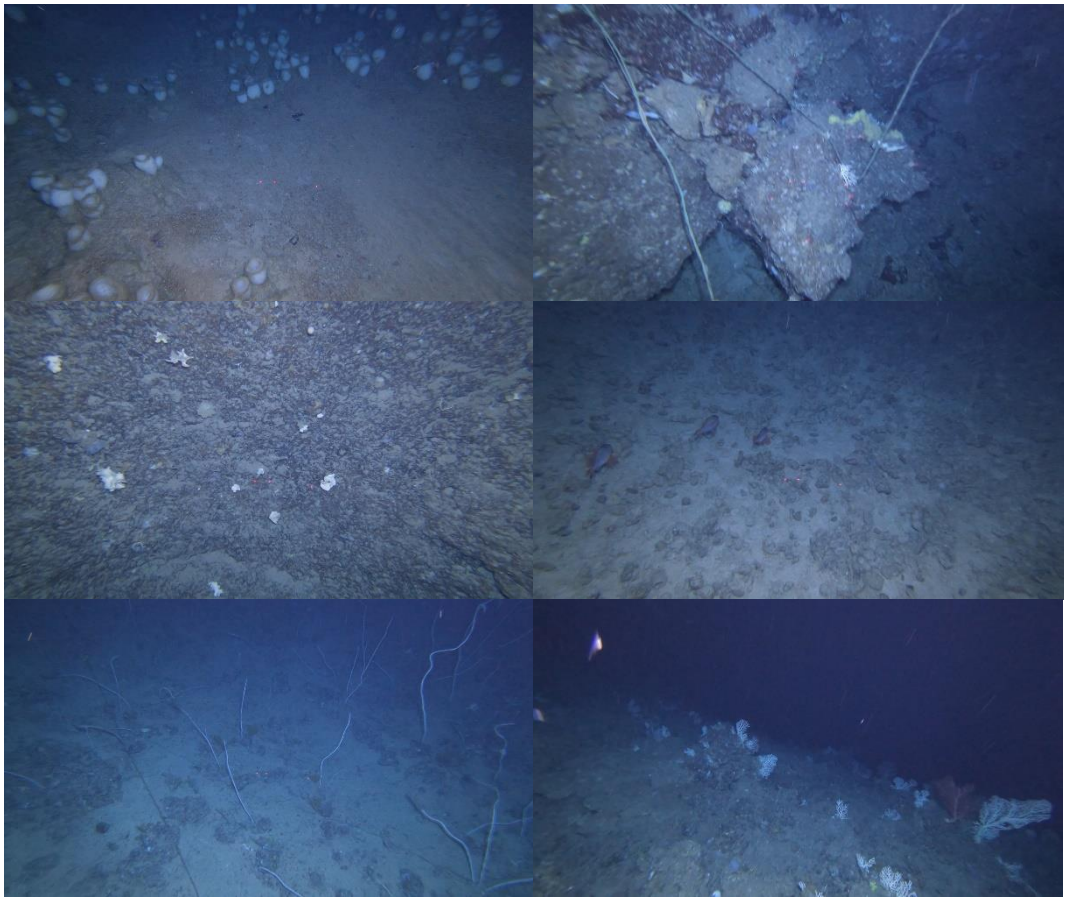


Figure 77. Screenshots extracted from the video footage recorded with the Azor drift-cam in Gastromar and Terceira E, during the 29th of July 2023

30 July 2023

In the last day in Terceira we left Praia da Vitória at 08:50 after carrying all our luggage to the vessel. The team plan was to explore Terceira S on the way back to Faial, however we were only able to perform one dive, since the skipper of MT Physeter was worried about not having enough fuel to get to our destination. The last dive of this Leg was performed at around 540m depth. The bottom was characterized by basaltic outcrops with sand

and some coral rubble, which were for the most part covered in encrusting sponges. We also noticed some *Viminella flagellum* aggregations, Hydrozoans and large sponges from the complex *Characella pachastrelloides.* After this dive, around 11:25, we packed our gear, washed the Azor drift-cam, and started sailing towards Faial, finishing the cruise sampling in Terceira. We arrived at Horta harbour around 15:40 and left all the gear ready for the next team, going in MT Physeter in two days.

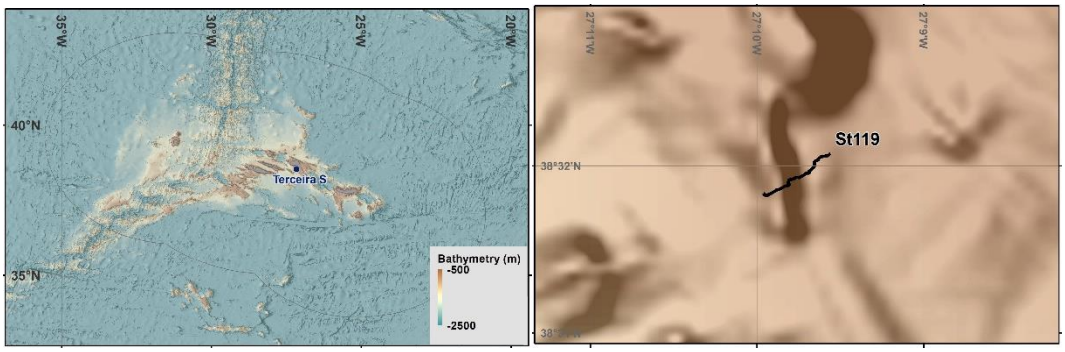


Figure 78. Location of the last dive conducted with the Azor drift-cam in Teceira S, during the 30th of July 2023

Figure 79. Screenshots extracted from the video footage recorded with the Azor drift- in Terceira S, during the 30th of July 2023

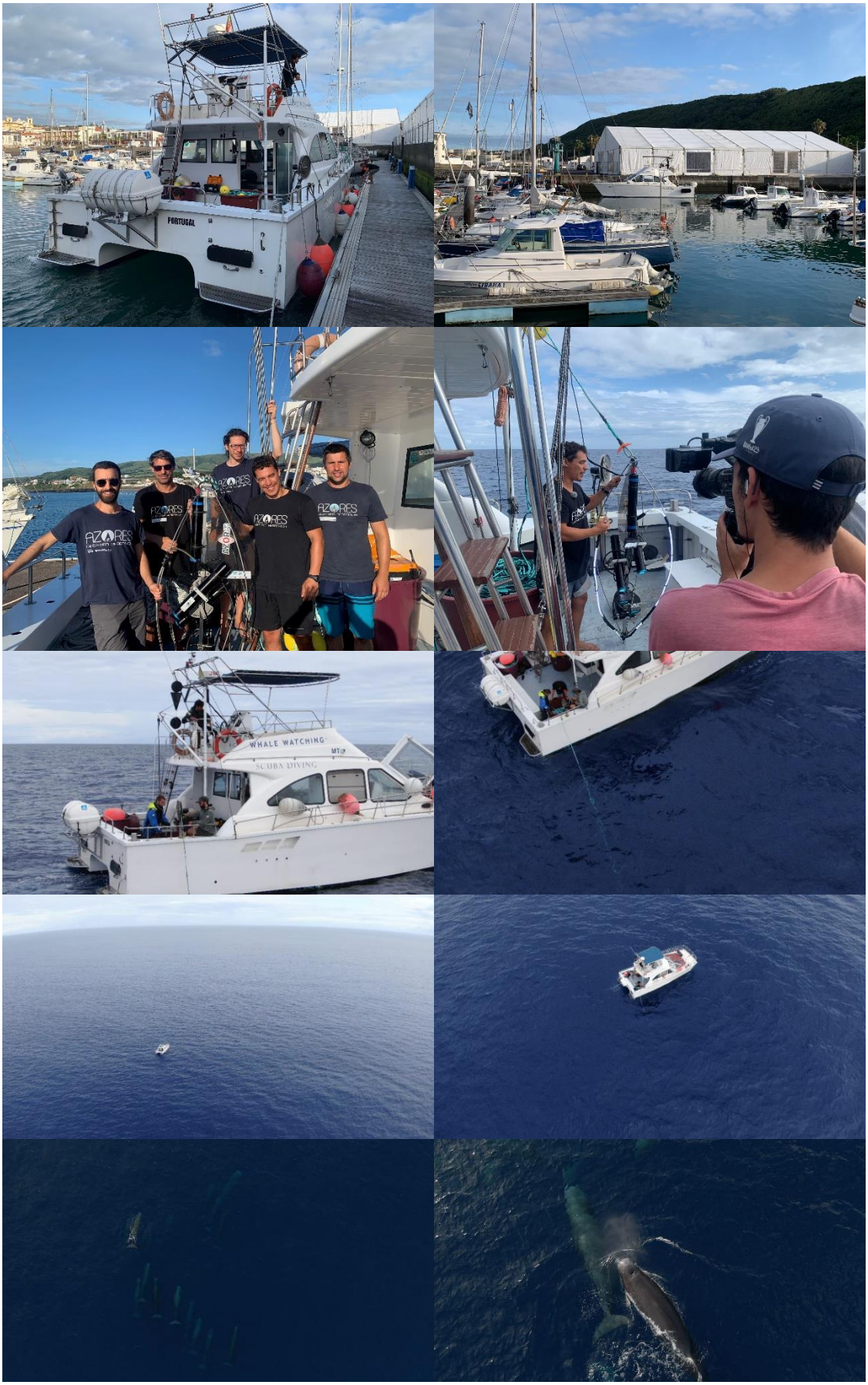
1.7 "LIFE" ON BOARD MT PHYSETER DURING MAPGES 2023 PART 1

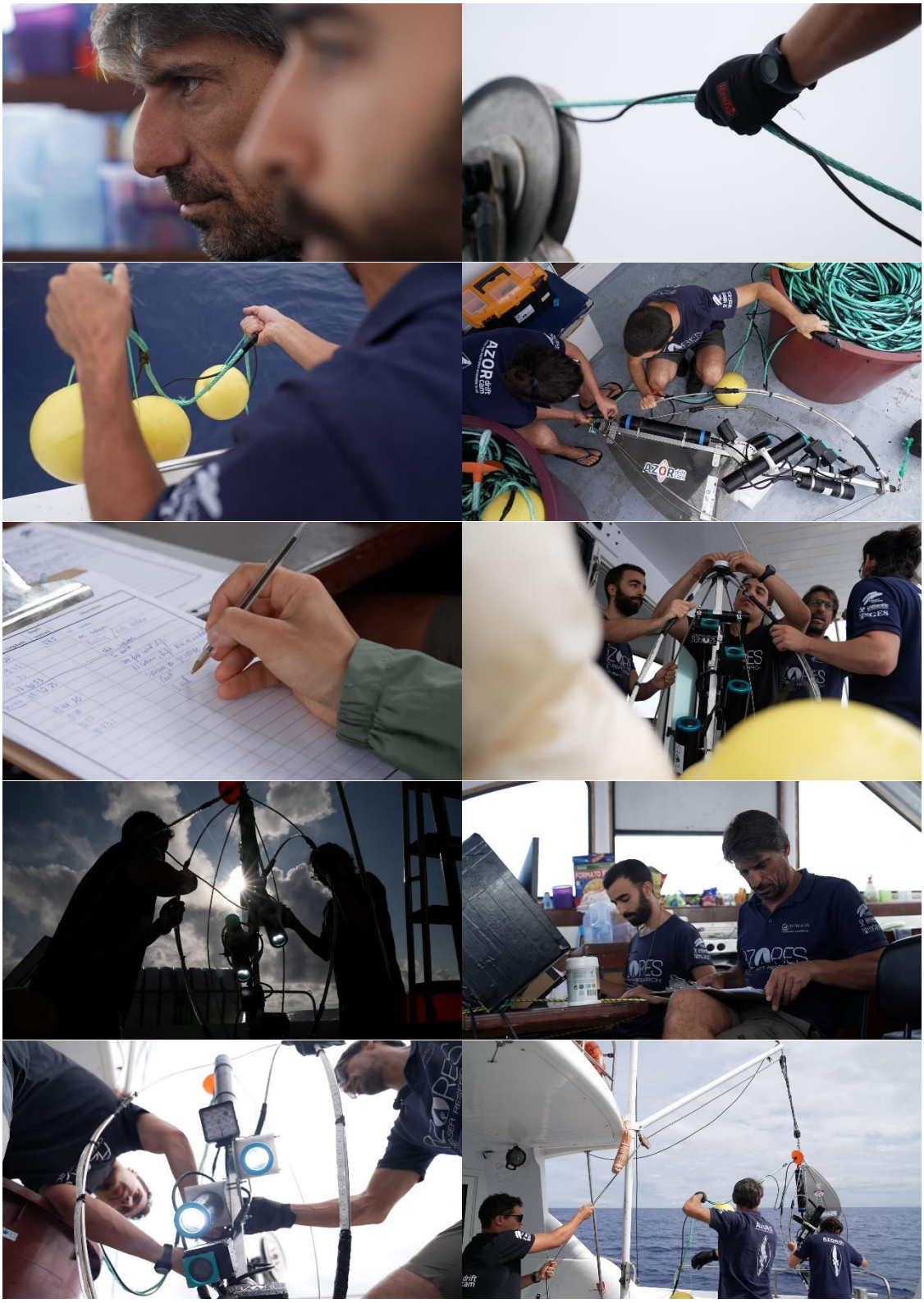
1.7.1 "Life" on board MT Physeter during MapGES 2023 Leg1

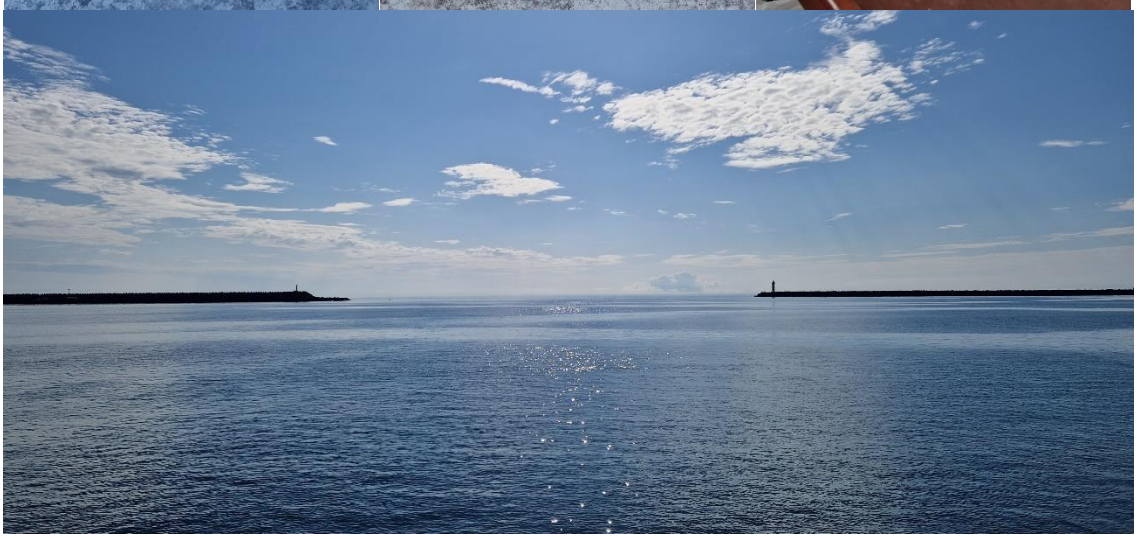

AZOR
WHALE WATCHING
SCUBA DIVING
PHYSETER
AZOR

1.7.2 "Life" on board MT Physeter during MapGES 2023 Leg2

1.7.3 "Life" on board MT Physeter during MapGES 2023 Leg3


PORTUGAL
AZORES
WHALE WATCHING
SCUBA DIVING





2 MAPGES 2023 MT PHYSETER: EXPLORATION AND MAPPING OF DEEP-SEA BIODIVERSITY IN THE AZORES Legs 4 and 5 - Slopes of São Miguel and São Jorge Islands

Authors: Gerald Taranto, Laurence Fauconnet, João Balsa, Isabel Areosa, Inês Bruno, Inês Carneiro, Nicolás Collazo, António Godinho, Guilherme Gonçalves, Alexandre Morais, Marc Pladevall, Alexandra Rosa, Marina Carreiro-Silva, Carlos Dominguez-Carrió, Telmo Morato

Date: 31 de outubro de 2023

2.1 RESUMO EM PORTUGUÊS

O MapGES 2023 é a continuação da nossa estratégia de longo prazo para mapear a biodiversidade do mar profundo dos Açores e identificar áreas que se enquadrem nos critérios de Ecossistemas Marinhos Vulneráveis (VMEs) usando o sistema de imagens Azor drift-cam. Neste cruzeiro, operamos a partir da embarcação Marítimo Turística MT Physeter e visitámos algumas áreas inexploradas em torno da Ilha de São Jorge, como São Jorge E Topo e São Jorge NE, e em torno da Ilha de São Miguel, como São Miguel N, NE, E, SE, S, SW, O, NO, e Mar da Prata Norte, e revistamos outras áreas São Jorge SE, e São Jorge S Urzelina. Tal como noutros cruzeiros MapGES, os objectivos foram (i) mapear as comunidades bentónicas que habitam montes submarinos, cordilheiras e encostas insulares inexplorados, (ii) identificar novas áreas que se enquadrem na definição de Ecossistema Marinho Vulnerável da FAO, e (iii) determinar os padrões de distribuição da biodiversidade bentónica de profundidade nos Açores. Os resultados deste cruzeiro somaram-se aos anteriores para identificar os drivers ambientais que determinam a distribuição espacial da biodiversidade bentónica de profundidade nos Açores. Ele também fornece informações valiosas no contexto do Bom Estado Ambiental (GES), Ordenamento do Espaço Marinho (MSP) e novos dados que ajudem à gestão sustentável dos ecossistemas do mar profundo.

A segunda parte da campanha MapGES 2023 MT Physeter foi composta por duas partes (4 e 5), que foram planeadas para visitar algumas áreas de bancos e montes submarinos na zona mais a sul e este da ilha de São Jorge e ao redor da ilha de São Miguel (Table 1 and Figure 1). Foram realizados 89 mergulhos bem-sucedidos, de entre dos 93 mergulhos totais, até 997 m de profundidade, em 12 áreas de amostragem distintas, percorrendo cerca de 55 km de fundo e produzindo 91 horas de imagens de vídeo. Durante a Leg 4, que decorreu de 31 de julho a 4 de agosto de 2023, realizámos 11 mergulhos bem-sucedidos com a Azor drift-cam (12 no total), onde exploramos as comunidades bentónicas de profundidade que habitam as encostas das estruturas geomorfológicas da zona Este, em que se inclui a área do Topo e a área NE, que constituíam uma falha no conhecimento da fauna bentónica ao redor desta ilha. Visitamos ainda as áreas Sudeste e Sul da ilha de São Jorge. Durante a Leg 5, de 15 de agosto a 15 de setembro de 2023, realizámos 78 mergulhos bem-sucedidos (81 no total) em diferentes unidades de amostragem ao redor da ilha de São Miguel e um pouco mais a sul da mesma, na extensa área do Mar da Prata Norte.

Esta campanha teve diversos destaques principais:

7. Visitaram-se dez estruturas geomorfológicas inexploradas na ZEE dos Açores listadas na Secção 8 do R1 "Avaliação de áreas com suficiente informação pré-existente e com substanciais lacunas de conhecimento" – São Jorge E Topo, São Miguel N, NE, E, SE, S, SW, O, NO, e Mar da Prata Norte. Conseguimos colmatar algumas lacunas de conhecimento sobre as comunidades bentónicas localizadas nas porções sudeste e oriental da Ilha de São Jorge (São Jorge SE e S Urzelina), uma zona de difícil acesso e exploração em

pequenas embarcações como o MT Physeter, que não tivemos a oportunidade de visitar em campanhas anteriores.

8. Esta foi a primeira vez que um extenso levantamento científico foi especificamente concebido para explorar, mapear e descrever as comunidades bentónicas de mar profundo que habitam margens, cristas, montes submarinos e encostas localizadas em torno da Ilha de São Miguel.
9. Durante as Leg 4 e 5 de MapGES 2023 a bordo do MT Physeter, realizamos 93 transectos com a Azor drift-cam, somando cerca de 91 horas de novas imagens de vídeo subaquáticas de habitats do mar profundo. Estes números representam um grande êxito, considerando que (i) operamos com sucesso, uma vez mais, a Azor drift-cam para exploração em mar profundo a bordo de uma pequena embarcação, muitas vezes atingindo locais relativamente remotos situados a mais de 40 milhas náuticas de distância do porto mais próximo e que (ii) a maioria dos dias de mar foram caracterizados por condições extremamente desafiantes.
10. Nas legs 4 e 5 do MapGES 2023, apesar de um grande número de mergulhos terem sido realizados em fundos sedimentares e arenosos, geralmente caracterizados por baixos níveis de biodiversidade, houve locais que mostraram extensas agregações de corais que são indicativos de ecossistemas marinhos vulneráveis (VMEs). Estas agregações foram encontradas principalmente em profundidades inferiores a 400-500 m e foram dominadas por colónias extraordinariamente grandes *de Callogorgia verticillata* e, menos frequentemente, por colónias de *Dentomuricea* aff. *meteor,* frequentemente misturadas com outras espécies de corais geralmente encontradas ao redor do arquipélago dos Açores, como *Viminella flagellum* e *Acanthogorgia* spp. Em poucas ocasiões, agregações extensas dos corais primnóides *Narella versluysi* e *Narella bellissima* foram observadas, estes em profundidades superiores a 500 m.
11. Destaca-se a observação, ao redor da ilha de São Miguel, de algumas agregações de corais que parecem ser particularmente raras de observar no arquipélago dos Açores. Estes incluem (i) uma vasta área completamente coberta por um recife do coral duro *Eguchipsammia cornucopia*; (ii) um jardim de corais extraordinariamente denso que inclui, entre outras espécies, o coral *Paragorgia johnsoni* (uma espécie que não parece ser muito comum nas encostas das ilhas), e densidades particularmente elevadas das espécies primnóides *Narella bellissima* e *N. versluysi*; iii) uma vasta área dominada por uma espécie não identificada da família Stylasteridae (ou seja, corais rendilhados); and iv) uma área dominada por um raro coral arroxeado, possivelmente pertencente ao género *Paramuricea*.
12. No que diz respeito às agregações de esponjas, os destaques destas duas Legs vão para (i) a observação de extensas áreas com a presença de *Pseudotrachya hystrix*, principalmente nos fundos arenosos, (ii) o avistamento frequente de exemplares de grandes dimensões de *Characella pachastrelloides* complex, e (iii) a observação frequente de agregações grandes e disseminadas da chamada “Esponja ninho de pássaro", *Pheronema carpenteri*.
13. Uma possível nova espécie de peixe de profundidade poderá ter sido observada pela primeira vez no arquipélago dos Açores, denominada de *Gaidropsaurus* sp., e avistada em dois dias diferentes.
14. A alga invasora *Rugulopteryx okamurae*, que nos últimos anos tem tido uma presença cada vez mais frquente pela costa Açoreana, foi repetidamente observada em grandes manchas até profundidades de cerca de 900 m, sugerindo que o impacto desta espécie nas comunidades residentes pode não só limitar-se a zonas costeiras, mas também estender-se ao mar profundo dos Açores. Portanto, a fim de compreender completamente *como Rugulopteryx okamurae* altera a dinâmica de distribuição e nicho de espécies nativas e a extensão de seus impactos, há uma necessidade de investigar como esta afeta comunidades de baixa a alta profundidade.

15. Em geral, verificou-se que as comunidades bentónicas em redor da Ilha de São Miguel apresentam um aparente bom estado ambiental. Esta observação é particularmente relevante se considerarmos que esta área concentra uma parte significativa do esforço de pesca de fundo na Região dos Açores.

2.2 SUMMARY OF THE MAPGES 2023 PHYSETER CRUISE PART 2

2.2.1 Main objectives

MapGES 2023 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 imagery system. In these cruises, we operated from the MT Physeter and planned to visit some unexplored and diverse geomorphological structures around the Island of São Jorge, namely São Jorge Este Topo, Sudeste, Sul Urzelina, anda round São Miguel Island, namely São Miguel Norte, Nordeste, Este, Sudeste, Sul, Sudoeste, Oeste, Noroeste e Mar da Prata Norte. 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 Vulnerable Marine Ecosystem (VME) definition; and (iii) determine distribution patterns of deep-sea benthic biodiversity in the Azores. The results of this cruise added to the previous contributions to identify the environmental drivers that determine the spatial distribution of deep-sea benthic biodiversity in the Azores. It also provides valuable information in the context of Good Environmental Status (GES), Marine Spatial Planning (MSP) and new insights on how to sustainably manage deep-sea ecosystems.

2.2.2 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 MT Physeter. In each sampling area or geomorphological structure, a representative number of dives (or transects) was carried out with our video camera system from a depth of about 1 000 m to the shallowest depth of each structure. The objective was to obtain underwater images to characterize the biodiversity along the entire bathymetric gradient and substrate types of each structure. The video transects were planned according to the best bathymetry available, so that the camera system could move from deeper to shallower areas. This methodology was designed so that the collected images could have the best possible quality, maximizing the area of incidence of light and avoiding its dissipation in the water column (as in the case of descending transects). The transects carried out with the Azor drift-cam were planned to last approximately 60 min on the seafloor, with the system drifting over benthic habitats at an approximate speed of 0.5 to 1 knot. Under good atmospheric conditions, each working day allowed for 5 to 6 dives, corresponding to around 5 km of seafloor bottom explored per day.

Vessel

MT Physeter

Dates

Leg 4: 31st July to 4th August

Leg 5: 15th August to 15th September

2.2.3 Scientific team

Scientific team in Leg 4: Telmo Morato (Chief scientist), Guilherme Gonçalves, Inês Carneiro, João Balsa.

Scientific team in Leg 5: Gerald Taranto (Chief scientist), Laurence Fauconnet (Chief scientist), João Balsa (Chief scientist), Inês Bruno, António Godinho, Alexandra Rosa, Alexandre Morais, Nicolás Collazo, Isabel Areosa, Marc Pladevall, Telmo Morato.

2.2.4 Statistics

During the MapGES 2023 cruise on board the MT Physeter, Legs 4 and 5, we performed a total of 93 dives, covering about 55 km of seafloor and producing almost 91 hours of seafloor video footage.

Leg 4: We performed 12 dives with the Azor drift-cam down to 986 m depth, covering 10.38 km of seafloor and producing 12.80 hours of seafloor video footage.

Leg 5: We performed 81 dives with the Azor drift-cam down to 997 m depth, covering 44.45 km of seafloor and producing 77.93 hours of seafloor video footage.

2.2.5 Cruise summary

The second part of MapGES 2023 on board the MT Physeter was composed of two Legs (4 and 5), which were planned to visit unexplored banks, ridges, slopes and seamounts around the Islands of São Miguel and São Jorge (Table 1 and Figure 1). Out of the 93 dives attempted in 12 different sampling areas, 89 provided useful information about local deep-sea benthic communities. These numbers represent a big accomplishment once we consider the adverse atmospheric conditions present on most days of Leg 4 and 5, which posed a real challenge to the planning and execution of our work at sea. During Leg 4 (July 31 – August 04, 2023) we deployed the Azor drift-cam on geomorphological structures and slopes located on the eastern area of São Jorge Island. Out of the 12 dives attempted, 11 were successful and provided useful information about the benthic communities inhabiting this area. During Leg 5 (August 15 – September 15, 2023) we visited all the sampling areas defined around the Island of São Miguel: São Miguel North, Northeast, East, Southeast, South, Southwest, West and Northwest. In addition, we also visited the Northern part of Mar da Prata, an offshore bank located South/Southwest of São Miguel. Out of the 81 dives attempted, 78 were successful and provided useful information about the benthic communities inhabiting these areas.

Table 1. Areas surveyed during the Legs 4 and 5 of MapGES 2023, with information about the number of dives, the total distance of seafloor covered, and the number of hours spent collecting video footage on the seafloor.

Leg	Dates	Areas explored	Dives (n)	Dist. (m)	Bottom time (h)
4	31/07/2023 - 04/08/2023	São Jorge Island slopes and banks: E Topo, NE, SE and S Urzelina	11	10,380	12:48
5	15/08/2023 - 15/09/2023	São Miguel Island slopes, banks and seamounts: São Miguel N, NW, W, SW, S, SE, E, NE and Mar da Prata N	78	44,450	77:56
		Total	**89**	**54,830**	**90:44**

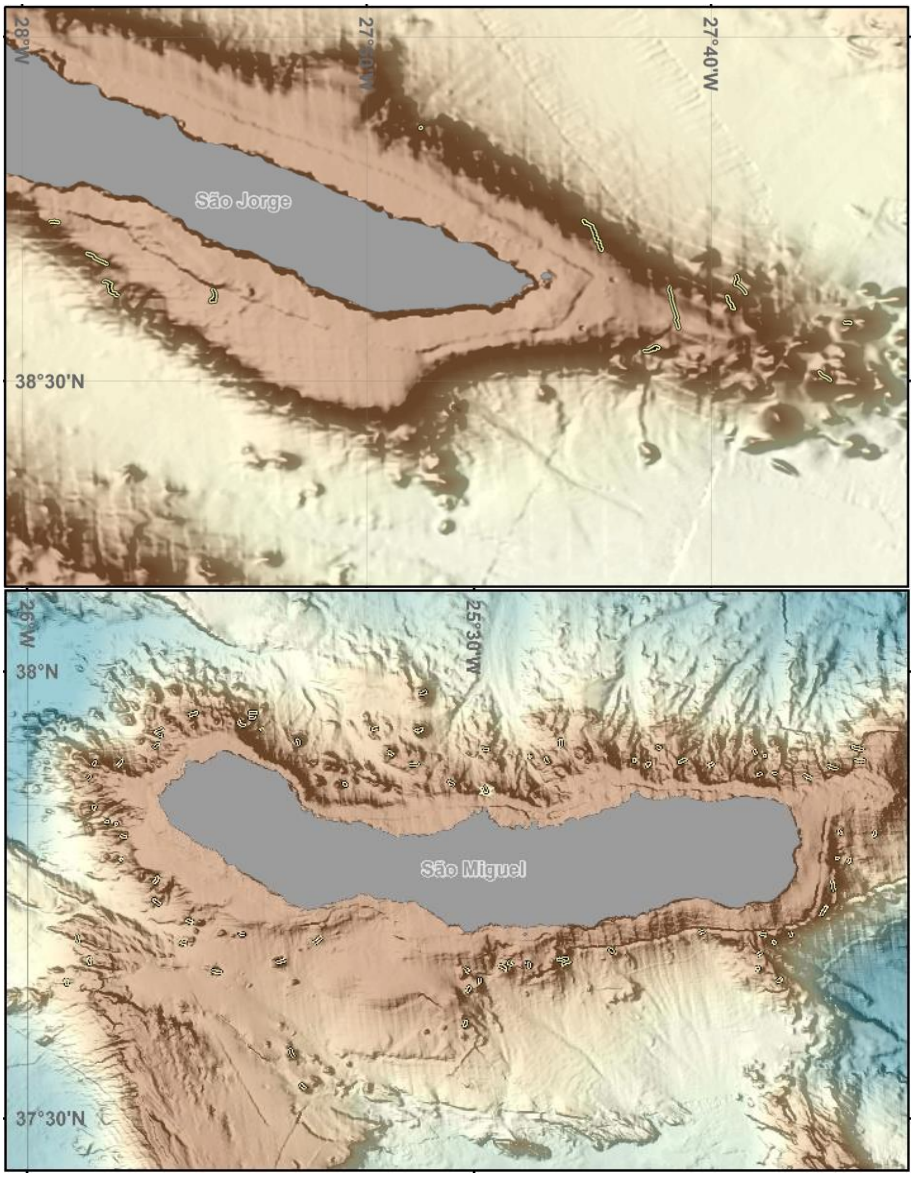


Figure 80. Location of the 93 dives performed with the Azor drift-cam on banks, ridges, seamounts and slopes around the Islands of São Jorge and São Miguel during the Legs 4 and 5 of MapGES 2023.

Figure 81. Some highlights of the footage recorded during the Legs 4 and 5 of MapGES 2023 on board the MT Physeter. (a) Coral aggregation mainly composed of large yellow colonies of *Dentomuricea* aff. *meteor* and orange colonies of *Acanthogorgia* spp.; (b) outcrop colonized by the whip coral *Viminella flagellum*. Note the presence of soft sediment even on step outcrops suggesting high deposition rates in this area; (c) coral garden featuring, among others, the bubblegum coral *Paragorgia johnsoni* (white and red morphotypes) and one colony of *Callogorgia verticillata*; (d) very dense garden dominated by the primnoid coral *Callogorgia verticillata*; (e) seafloor entirely covered by a reef constructed by the yellow looking stony coral *Eguchipsammia cornucopia*, the primnoid *Narella versluysi*, other coral species and a swallowtail sea perch (*Anthias anthias*) swimming by; (f) vertical wall presenting many fragments of the invasive alga *Rugulopteryx okamurae* covering small gorgonian corals; (g) aggregation of the primnoid coral *Narella versluysi*, the echinoderm *Cidaris cidaris* and the sponge cf *Asconema fristedti* (h) colonies of the long-lived black coral *Leiopathes expansa*; (i) shoals of boarfish (*Capros aper*); (j) A possible new deep-sea fish species for the Azorean archipelago *Gaidropsaurus* sp.

2.2.6 Main achievements

1. Were able to visit ten unexplored geomorphological structures in the Azores EEZ listed in the Section 8 of the R1 report "Evaluation of areas with sufficient pre-existing information and with substantial knowledge gaps" – – São Jorge E Topo, São Miguel N, NE, E, SE, S, SW, O, NO, e Mar da Prata Norte. We managed to fill some knowledge gaps about the benthic communities located in the southeast and eastern portions of São Jorge Island (São Jorge SE and S Urzelina), an area that was difficult to access and explore from small vessels like the MT Physeter, which we did not have the opportunity to visit in previous campaigns.
2. This was the first time an extensive scientific survey was specifically designed to map and describe deep-sea benthic communities inhabiting banks, ridges, seamounts, and slopes located around the Island of São Miguel.
3. During the Leg 4 and 5 of MapGES 2023 on board the MT Physeter, we performed 93 video transects with the Azor drift-cam, adding up to around 91 hours of new underwater video footage of seabed habitats. These numbers represent a big achievement considering that (i) we successfully operated, once again, the Azor drift-cam for deep-sea exploration on board a small vessel often reaching very remote locations situated more than 40 nm away from the closest harbour and that (ii) most days at sea were characterized by an extremely challenging weather.
4. In both Legs 4 and 5 of MapGES 2023, most of the dives performed covered sections of sedimentary bottoms, usually characterized by low levels of biodiversity. Nevertheless, there were locations showing extensive coral aggregations that potentially are indicative of Vulnerable Marine Ecosystems. These aggregations were mostly encountered at depths shallower than 400-500 m depth and were dominated by extraordinarily large colonies of *Callogorgia verticillata* and, less frequently, by colonies of *Dentomuricea* aff. *meteor* often mixed with other coral species commonly found around the archipelago of the Azores, such as *Viminella flagellum* and *Acanthogorgia* spp. On few occasions, extensive aggregations of the primnoid corals *Narella versluysi* and *Narella bellissima* were observed at depths greater than 500 m.
5. Noteworthy is the observation, during Leg 5, of some coral aggregations that appear to be particularly rare in the archipelago of the Azores. These include (i) a vast area completely covered by a reef of the stony coral *Eguchipsammia cornucopia*; (ii) an extraordinarily dense coral garden featuring, among other species, the bubble gum coral *Paragorgia johnsoni* (a species that do not appear to be very common on island slopes), and particularly high densities of the primnoid species *Narella bellissima* and *N. versluysi*; (iii) a large area dominated by an unidentified species of the family Stylasteridae (i.e. lace corals); (iv) an area dominated by a rare purple coral most likely of the genus *Paramuricea*; (v) an aggregation of black corals (order Antipatharia) on the northern part of Mar da Prata Bank.
6. Regarding sponge aggregations, the highlights of these two legs are (i) on the observation of extensive areas with the presence of the species *Pseudotrachya hystrix*, mainly encountered at the common sandy floors where we usually drifted over, (ii) some frequent sighting of even bigger specimens of the often-robust *Characella pachastrelloides* complex and, (iii) the frequent notice of big and widespread aggregations of the "bird's nest" sponge, *Pheronema carpenteri*.
7. A potential new species of deep-sea fish may have been observed for the first time in the Azores archipelago, named *Gaidropsaurus* spp., spotted in two different days.
8. The invasive alga *Rugulopteryx okamurae*, that in recent years appeared on most Azorean shores, was very frequently observed in large patches down to depths of about 900 m suggesting that the impact of this species on resident communities may not only be limited to coastal areas, but also extend into the deep

sea of the Azores. Therefore, to fully understand how *Rugulopteryx okamurae* alters the distributional and niche dynamics of native species and the extent of its impacts, there is a need to investigate how it affects both shallow and deep-sea communities.

9. In general, it was found that the benthic communities around São Miguel Island present an apparent good environmental status. This observation is particularly relevant if we consider that this area concentrates a significant part of the bottom fishing effort in the Azores Region.

2.3 STATIONS SURVEYED DURING MAPGES 2023 CRUISE ONBOARD THE MT PHYSETER PART 2

During MapGES 2023 #4 on board the MT Physeter we successfully completed a total of 89 dives out of the 93 stations attempted in 13 different sampling areas. Table 2 presents a compilation of all the stations surveyed during Legs 4 and 5 of MapGES 2023 #4.

Table 2. Metadata of the stations surveyed during Legs 4 and 5 of MapGES 2023 #4 on board the MT Physeter.

			Time		Start position		End position		Depth		Dist.
St	Location	Date	Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)	Start	End	(m)
St120	S. Jorge E Topo	01/08/23	10:47	12:52	38.514	-27.699	38.516	-27.692	721	511	650
St121	S. Jorge E Topo	01/08/23	13:09	14:18	38.540	-27.658	38.535	-27.655	589	486	690
St122	S. Jorge E Topo	01/08/23	15:03	16:49	38.551	-27.654	38.542	-27.649	986	757	1090
St123	S. Jorge E Topo	01/08/23	17:04	18:57	38.545	-27.686	38.525	-27.682	428	272	2260
St124	S. Jorge E Topo	02/08/23	09:40	10:54	38.504	-27.614	38.500	-27.608	767	683	620
St125	S. Jorge E Topo	02/08/23	11:09	13:01	38.528	-27.602	38.527	-27.599	965	934	280
St126	S. Jorge E Topo	02/08/23	13:35	15:30	38.577	-27.728	38.563	-27.719	674	245	1750
St127	S. Jorge NE	02/08/23	16:15	16:51	38.623	-27.807	38.622	-27.807	735	535	40
St128	S. Jorge SE	02/08/23	17:47	19:13	38.539	-27.908	38.544	-27.907	194	217	620
St129	S. Jorge SE	03/08/23	08:51	10:52	38.541	-27.953	38.548	-27.960	764	734	970
St130	S. Jorge SE	03/08/23	11:07	12:45	38.556	-27.958	38.561	-27.969	503	505	1080
St131	S. Jorge S Urzelina	03/08/23	13:02	13:32	38.576	-27.982	38.577	-27.986	222	244	330
St132	São Miguel N	16/08/23	11:31	12:53	37.909	-25.595	37.907	-25.590	621	489	480
St133	São Miguel N	16/08/23	13:20	15:11	37.974	-25.560	37.977	-25.553	937	844	660
St134	São Miguel N	16/08/23	15:40	17:12	37.933	-25.565	37.935	-25.558	822	699	630
St135	São Miguel N	16/08/23	17:33	19:38	37.876	-25.527	37.873	-25.522	461	283	550
St136	São Miguel N	18/08/23	14:34	15:37	37.870	-25.488	37.865	-25.486	442	296	610
St137	São Miguel NE	18/08/23	16:04	17:32	37.902	-25.419	37.897	-25.416	577	428	650
St138	São Miguel NE	18/08/23	17:43	18:39	37.905	-25.437	37.904	-25.437	906	892	100
St139	São Miguel NE	18/08/23	18:53	20:19	37.923	-25.403	37.917	-25.402	788	721	650
St140	São Miguel NE	19/08/23	09:37	11:03	37.901	-25.320	37.899	-25.321	480	431	170
St141	São Miguel NE	19/08/23	11:16	12:26	37.897	-25.302	37.894	-25.305	446	277	400
St142	São Miguel NE	19/08/23	12:46	14:25	37.902	-25.262	37.898	-25.269	660	426	760
St143	São Miguel NE	19/08/23	14:40	16:32	37.897	-25.232	37.894	-25.235	689	545	400
St144	São Miguel NE	19/08/23	16:56	17:56	37.915	-25.294	37.914	-25.291	724	566	330
St145	São Miguel NW	20/08/23	08:58	10:36	37.917	-25.696	37.923	-25.698	798	546	670
St146	São Miguel NW	20/08/23	11:04	12:45	37.949	-25.746	37.947	-25.751	871	644	520
St147	São Miguel NW	20/08/23	12:55	14:52	37.953	-25.744	37.954	-25.750	947	756	600
St148	São Miguel NW	20/08/23	15:04	16:27	37.939	-25.757	37.944	-25.763	476	399	810
St149	São Miguel NW	20/08/23	16:42	17:22	37.934	-25.737	37.936	-25.738	770	749	170
St150	São Miguel S	22/08/23	09:18	10:06	37.675	-25.460	37.671	-25.457	433	386	450
St151	São Miguel S	22/08/23	10:21	12:16	37.670	-25.470	37.666	-25.464	583	386	710
St152	São Miguel S	22/08/23	12:29	13:14	37.674	-25.440	37.671	-25.439	351	341	270
St153	São Miguel S	22/08/23	13:24	14:25	37.674	-25.438	37.669	-25.438	310	340	520
St154	São Miguel S	22/08/23	14:47	16:34	37.656	-25.493	37.652	-25.494	634	425	450
St155	São Miguel S	22/08/23	16:50	18:16	37.667	-25.510	37.663	-25.506	432	443	580
St156	São Miguel SW	23/08/23	11:15	12:40	37.769	-25.854	37.763	-25.858	453	373	750
St157	São Miguel W	23/08/23	13:21	14:37	37.832	-25.910	37.831	-25.911	869	853	150
St158	São Miguel W	23/08/23	14:51	15:34	37.829	-25.900	37.829	-25.901	699	766	70
St159	São Miguel W	23/08/23	15:45	17:11	37.814	-25.890	37.815	-25.895	473	413	480
St160	São Miguel W	23/08/23	17:28	18:06	37.790	-25.895	37.789	-25.895	718	746	60
St161	São Miguel SW	24/08/23	09:26	10:46	37.677	-25.711	37.674	-25.720	536	382	830
St162	São Miguel SW	24/08/23	11:23	12:56	37.702	-25.671	37.696	-25.679	349	437	1010
St163	São Miguel S	25/08/23	08:34	10:25	37.678	-25.395	37.677	-25.405	610	363	860
St164	São Miguel S	25/08/23	10:42	12:11	37.675	-25.395	37.672	-25.400	684	487	600
St165	São Miguel S	25/08/23	15:07	16:06	37.678	-25.472	37.678	-25.481	511	333	730
St166	São Miguel SW	29/08/23	10:17	11:54	37.663	-25.784	37.665	-25.794	607	486	900
St167	São Miguel SW	29/08/23	12:20	13:30	37.695	-25.822	37.697	-25.828	612	652	550
St168	São Miguel SW	29/08/23	13:48	15:52	37.739	-25.852	37.744	-25.859	805	598	840
St169	São Miguel SW	29/08/23	16:13	17:51	37.719	-25.816	37.721	-25.821	644	540	520
St170	São Miguel SW	29/08/23	18:11	19:12	37.705	-25.757	37.707	-25.763	403	432	550
St171	São Miguel SE	30/08/23	10:10	11:25	37.755	-25.097	37.766	-25.099	410	218	1170
St172	São Miguel SE	30/08/23	11:46	13:48	37.726	-25.111	37.737	-25.105	792	443	1290

			Time		Start position		End position		Depth		Dist.
St	Location	Date	Start	End	Lat. (N)	Long. (W)	Lat. (N)	Long. (W)	Start	End	(m)
St173	São Miguel SE	30/08/23	14:18	15:41	37.695	-25.164	37.698	-25.165	846	755	280
St174	São Miguel SE	30/08/23	15:51	16:45	37.704	-25.169	37.705	-25.171	557	476	250
St175	São Miguel SE	30/08/23	17:10	18:25	37.705	-25.172	37.706	-25.179	574	370	560
St176	São Miguel E	31/08/23	11:59	13:14	37.817	-25.090	37.823	-25.091	424	298	640
St177	São Miguel E	31/08/23	13:30	15:04	37.816	-25.053	37.820	-25.051	651	547	500
St178	São Miguel E	31/08/23	15:25	17:00	37.787	-25.080	37.789	-25.079	874	783	290
St179	São Miguel E	31/08/23	17:12	18:08	37.791	-25.093	37.791	-25.094	634	578	90
St180	São Miguel E	01/09/23	10:26	12:23	37.901	-25.078	37.900	-25.063	649	306	1290
St181	São Miguel E	01/09/23	12:37	14:48	37.915	-25.076	37.912	-25.065	928	588	1020
St182	São Miguel E	01/09/23	15:03	16:55	37.894	-25.104	37.891	-25.094	898	482	1000
St183	São Miguel E	01/09/23	17:03	18:47	37.884	-25.131	37.880	-25.122	520	357	900
St184	São Miguel SE	02/09/23	12:58	14:25	37.704	-25.144	37.707	-25.146	775	676	390
St185	São Miguel SE	02/09/23	14:46	16:26	37.653	-25.160	37.655	-25.156	819	818	400
St186	São Miguel SE	02/09/23	16:39	17:42	37.668	-25.182	37.667	-25.182	663	712	100
St187	São Miguel SE	02/09/23	17:54	18:47	37.685	-25.178	37.683	-25.183	613	566	490
St188	São Miguel SE	02/09/23	19:06	19:58	37.709	-25.243	37.707	-25.247	615	574	420
St189	São Miguel NE	03/09/23	10:37	11:40	37.886	-25.178	37.884	-25.182	478	382	380
St190	São Miguel NE	03/09/23	11:53	13:05	37.906	-25.174	37.905	-25.174	944	874	120
St191	São Miguel NE	03/09/23	13:27	15:01	37.911	-25.186	37.908	-25.184	800	771	330
St192	São Miguel E	03/09/23	15:14	16:36	37.886	-25.164	37.885	-25.160	592	561	320
St193	São Miguel S	07/09/23	10:24	11:59	37.609	-25.509	37.604	-25.511	698	661	610
St194	São Miguel S	09/09/23	9:59	11:08	37.647	-25.505	37.641	-25.506	512	470	620
St195	São Miguel S	09/09/23	11:58	13:21	37.689	-25.347	37.686	-25.345	620	592	380
St196	Mar da Prata N	09/09/23	15:42	17:23	37.577	-25.706	37.569	-25.702	798	739	950
St197	Mar da Prata N	09/09/23	17:47	19:03	37.538	-25.693	37.533	-25.689	878	723	600
St198	São Miguel W	10/09/23	10:44	12:13	37.846	-25.926	37.848	-25.925	820	715	260
St199	São Miguel W	10/09/23	12:40	13:53	37.883	-25.930	37.880	-25.933	602	589	400
St200	São Miguel W	10/09/23	14:13	15:09	37.899	-25.924	37.896	-25.927	628	440	400
St201	São Miguel W	10/09/23	15:26	16:47	37.900	-25.895	37.895	-25.899	668	420	670
St202	São Miguel NW	11/09/23	11:29	12:27	37.928	-25.853	37.929	-25.851	656	654	150
St203	São Miguel NW	11/09/23	12:47	14:10	37.919	-25.854	37.915	-25.858	709	583	550
St204	São Miguel NW	11/09/23	14:38	16:28	37.954	-25.811	37.951	-25.818	607	414	660
St205	São Miguel NW	11/09/23	16:43	18:11	37.935	-25.850	37.931	-25.856	605	629	680
St206	São Miguel N	12/09/23	10:47	13:14	37.936	-25.607	37.936	-25.614	969	836	630
St207	São Miguel N	12/09/23	13:42	15:40	37.896	-25.563	37.895	-25.572	612	422	860
St208	São Miguel N	12/09/23	16:04	17:20	37.913	-25.484	37.912	-25.489	900	847	440
St209	São Miguel N	12/09/23	17:54	19:06	37.873	-25.644	37.875	-25.645	562	517	310
St210	Mar da Prata N	13/09/23	10:56	12:35	37.698	-25.943	37.706	-25.946	875	743	890
St211	Mar da Prata N	13/09/23	13:03	14:18	37.651	-25.956	37.654	-25.957	997	996	410
St212	Mar da Prata N	13/09/23	14:37	16:34	37.673	-25.931	37.680	-25.931	864	740	710

2.4 Report of the MT Physeter Leg 4

2.4.1 Summary of MT Physeter Leg 4

Objective: to conduct a rapid appraisal of the deep-sea benthic communities dwelling on the slopes of São Jorge Island (namely Urzelina, Calheta and Topo areas) on board of the MT Physeter. 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 12 dives with the Azor drift-cam down to 990 m depth, covering about 10.4 km of the seafloor and producing 12.8 hours of video footage.

Vessel: MT Physeter

Dates: 31 July – 04 August 2023

Scientific team: Telmo Morato (chief scientist), Guilherme Gonçalves, Inês Carneiro, João Balsa.

Figure 82. Scientific team on board the MT Physeter that participated in the Leg 4 of the MapGES 2023 cruise.

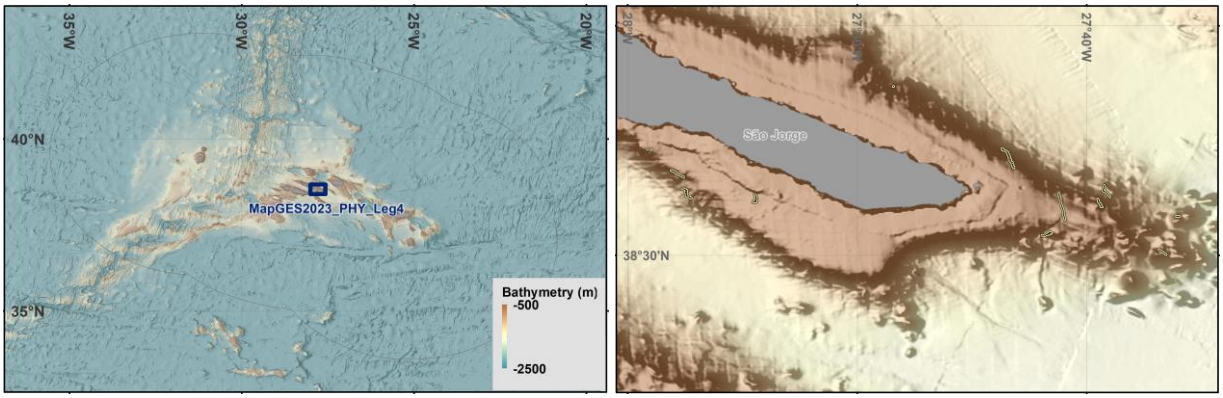


Figure 83. Location of the 12 video transects (black lines) carried out with the Azor drift-cam during Leg 4 of MapGES 2023 survey onboard the MT Physeter.

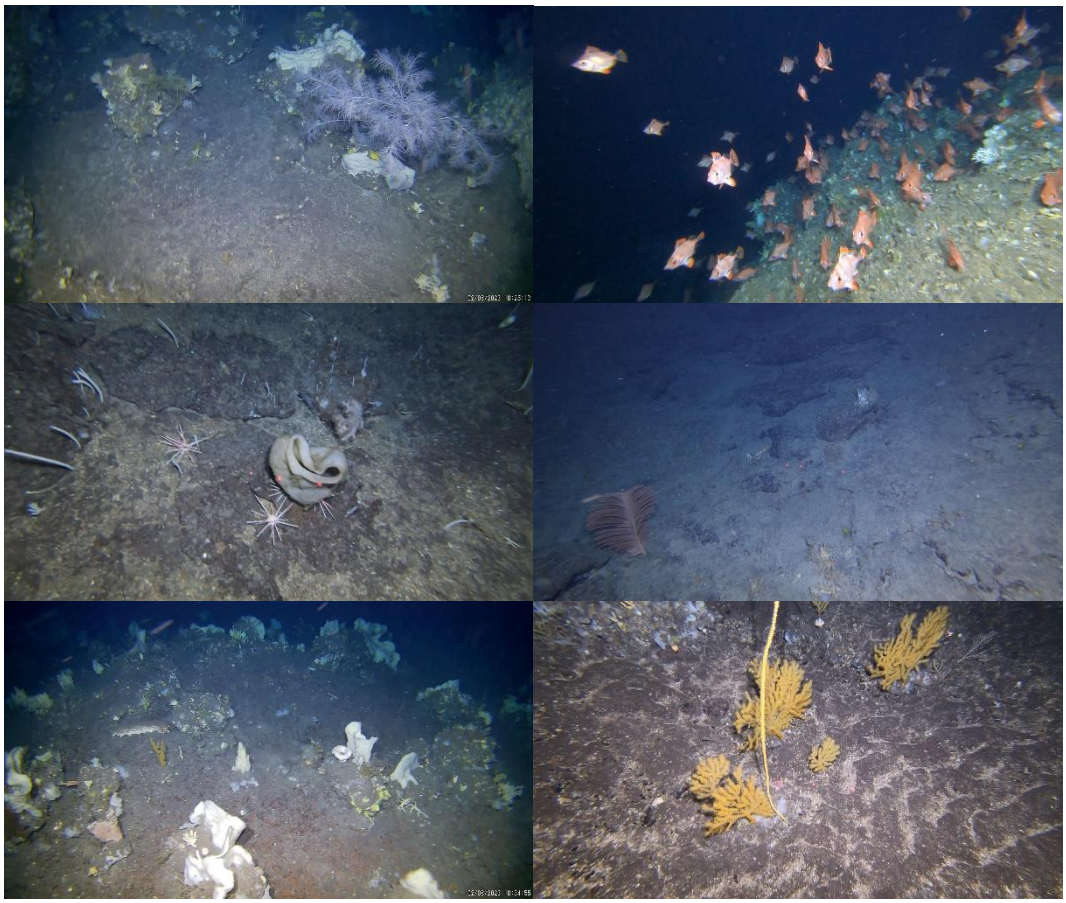


Figure 84. Screenshots taken from the footage recorded during the Leg 4 of MapGES 2023 cruise on board the MT Physeter. (a) A large colony of the black coral *Leiopathes glaberrima*; (b) shoal of boarfish (*Capros aper*); (c) aggregation of the primnoid coral *Narella versluysi*, the echinoderm *Cidaris cidaris* and the sponge *Asconema fristedti*; (d) a black coral of the genus *Bathypathes* dwelling on rocky grounds covered by sand; (e) sponge dominated habitat including the species *Poecillastra compressa*, *Farrea occa*, among others and a solitary *Acanthogorgia* spp.; (f) several coral colonies of the genus *Acanthogorgia* and one colony of the whip coral *Viminella flagellum* in its yellow morphotype.

2.4.2 Cruise diary of MT Physeter Leg 4

31 July 2023

The first day of Leg 4 of MapGES 2023 cruise was used to re-load all the necessary gears on board the MT Physeter and to conclude the necessary maintenance of the Azor drift-cam. In fact, during the first three Legs on board the Physeter, our camera systems suffered some damages that needed to be attended. We also used this day to organize all our equipment on the boat. We spent the entire day in the harbour and got ready to leave early in the morning of the next day, towards Topo, an area located on the Eastern tip of São Jorge Island.

1 August 2023

We left Horta harbour around 8h20 in direction of Topo, an area located on the Eastern tip of São Jorge Island 40 nm from Horta, where we arrived at 10h30. The weather and sea conditions were great with almost no swell during the trip. We performed 4 dives during the day, between 270 and 990 m depth, with very good and long drifts. We were able to cover 4,690 m of seafloor. The performed dives covered different depth ranges and were characterized by a different composition, diversity and density of benthic fauna.

The first and second dive of the day were generally poor in terms of biodiversity, with only a few small and sparse corals of the species *Acanthogorgia* spp., *Hemicorallium niobe* (St120), *Viminella flagellum* (St121) and *Elatopathes abietina* (St121). Concerning the sponges' communities observed, we identified several individuals from the complex *Characella pachastrelloides*, *Geodia* spp. and *Haliclona magna* at St120. During the second dive of the day, the umbilical of the Azor drift-cam got entangled on the winch and broke. We lost the live view connection, but after a prompt but provisional repair of the electric cable we were able to continue the dive. While coming to the surface after finishing the dive, we lost the weight of the camera system. Before heading to the next station, we properly repaired the umbilical and set up a new weight. The third dive of the day was characterized by basaltic outcrops covered by soft sediments and some sandy bottom areas. The rocky areas hosted diverse benthic communities with patches of abundant coral gardens of *Candidella imbricata* with the cup coral *Leptopsammia formosa*, *Narella versluysi* with some scattered *Narella bellissima*, occasional stylasterids and *Bathypathes* sp., among many other species. In these areas, we also observed some scattered glass sponges such as *Farrea occa*, *Regadrella phoenix*, large *Asconema* sp., the bird's nest *Pheronema carpenteri*, and the big sponge *Leiodermatium* (white morphotype). The soft bottom portions of this dive were full of sea urchins' *Cidaris cidaris* aggregations. The last dive of the day was impressive, although mostly characterized by sandy nature. We drifted over some small aggregations of the hydrozoan *Lytocarpia myriophyllum*, some small and dispersed aggregations of the coral species *Viminella flagellum* (yellow and white morphotypes), occasional colonies of *Paracalyptrophora josephinae* and *Dentomuricea* cf. *meteor*; as well as some sponges *Neophrissospongia nolitangere*, *Haliclona implexa*, and *Leiodermatium* (white and blue morphotypes). But the highlight of the day was an extensive and large aggregations of *Acanthogorgia* spp. during this last dive of the day. Regarding fauna, in most dives we encountered the crabs *Paromola cuivieri*, in one case carrying some *Acanthogorgia* sp., some occasional bluemouth rockfish (*Helicolenus dactylopterus*), silver roughy (*Hoplostethus mediterraneus*), *Mora moro*, *Anthias anthias*, and some shoals of *Capros aper* especially curious during the second dive where they approached the camera while we were trying to repair the cable. We also spotted some interesting rays such as *Raja clavata* and *Tetronarce nobiliana* (camouflaged under the sand), as well as one kite fin shark (*Dalatias licha*). After the last dive, we transited to Calheta village where we had dinner at the restaurant "Amigos" and spent the night at the simple but cosy "Solmar" residential.

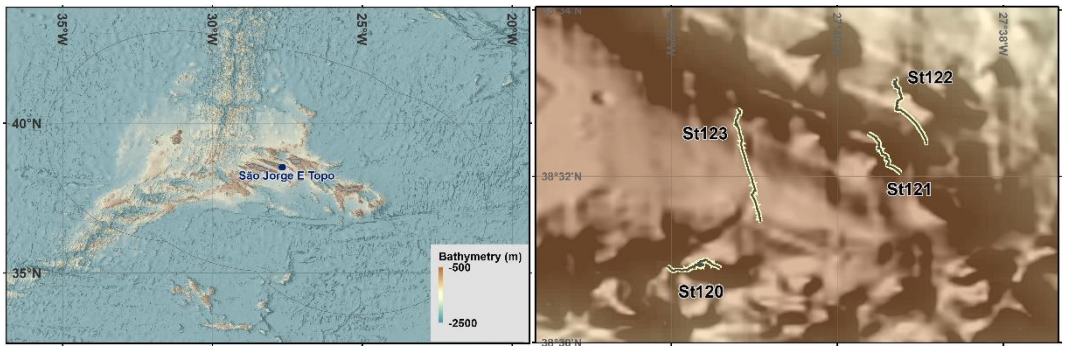


Figure 85. Location of São Jorge E Topo and the dives conducted with the Azor drift-cam in this area, 1st August 2023.

Figure 86. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Jorge E Topo, 1st August 2023.

2 August 2023

We left Calheta de São Jorge harbour at around 8h20 in direction to Topo, where we arrived after around 1 hour of transit. During the day, we performed 5 dives between 190 m and 960 m depth. The first dive started at 9h40 in an area with mainly coral rubble substrate. This dive was characterized by small and scattered aggregations of *Narella versluysi* and *Narella bellissima*, with some occasional *Acanthogorgia* spp. and *Pseudoanthomastus* spp. In terms of sponges, we could only spot some individuals of the glass sponge *Farrea occa*. The second dive was the deepest of the day (965-934 m depth) and was characterized by the soft substrate typical of deep areas, and some basaltic outcrops while going uphill. The unconsolidated substrates

showed the typical fauna present at such depths, which included the corals *Acanella arbuscula* and *Chrysogorgya sp., Leptopsammia formosa* and occasional *Bathypathes* sp. During this dive we could only identify one sponge, *Regadrella phoenix*. The last three dives were performed in areas with strong sediment deposition, with occasional rocky outcrops harbouring some fauna. We observed several sponge species such as the lamellate *Poecillastra compressa, Macandrewia azorica, Xestospongia variablis* and some large sponges belonging to the *Characella pachastrelloides* complex and to the genus *Geodia*. During the last dive, we spotted colonies of *Acanthogorgia* spp. and some large black corals of the species *Leiopathes glaberrima*. Concerning fauna, we identified several species such as the bluemouth rockfish (*Helicolenus dactylopterus*), *Molva macrophthalma, Hoplostethus mediterraneus*, an angler fish (*Lophius piscatorius*) and the crab *Paromola cuivieri.* The 4th dive (St127), located in São Jorge NE, was aborted because of the strong wind and rough sea conditions. We struggled to recover the equipment, but we successfully brought it to surface without any major problem. We moved to the southern side of the Island where we performed the 5th dive of the day in São Jorge SE (St128). After retrieving the video footage from the GoPro camera, we realized that the image was much darker than usual, making it barely possible to see the seafloor. Probably the camera settings were accidentally changed, since the Gitup footage seemed to be fine. We transited back to Calheta where we stayed overnight. We took a ride from the Solmar owner to the "Sabores Sopranos" restaurant where we had a nice dinner and a great 30 minutes' walk back to the harbour.

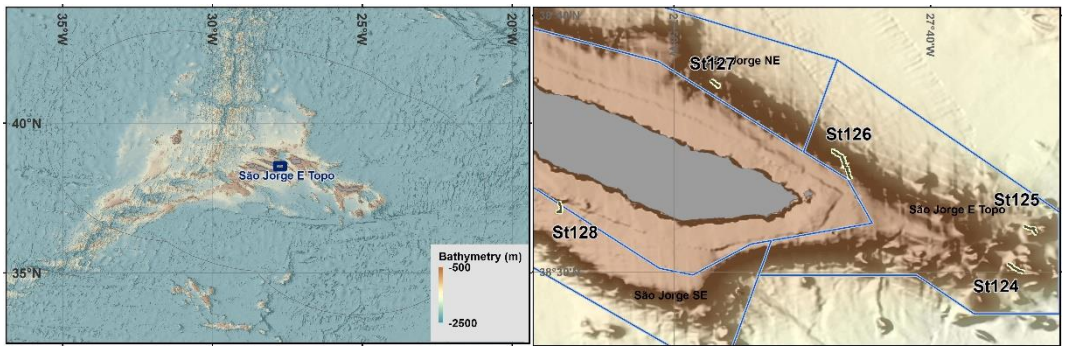


Figure 87. Location of São Jorge E Topo, NE and SE and the dives conducted with the Azor drift-cam in these areas, 2nd August 2023.

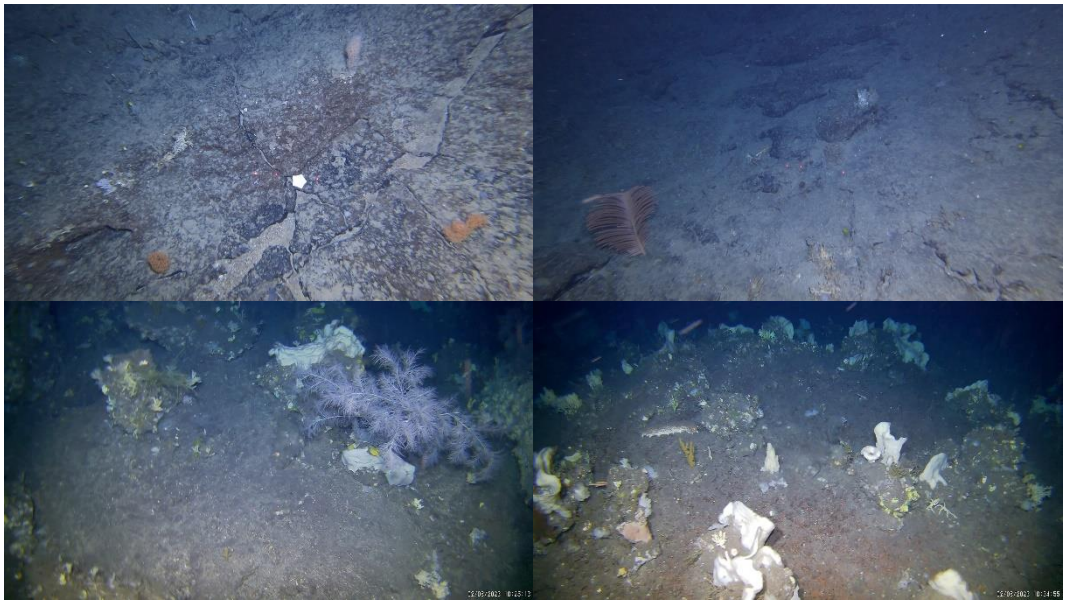


Figure 88. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Jorge E Topo, NE and SE, 2nd August 2023.

3 August 2023

The last day of Leg 4 in São Jorge Island was dedicated to complement previous surveys conducted with the submersible Lula in São Jorge SE and S, close to Calheta village. We were able to perform three dives between 220 m and 760 m depth. Most of the areas explored were relatively bare, with large sections of soft bottoms characterizing the seafloor. Nevertheless, we observed an extensive field of the glass sponge *Hyalonema (Cyliconema) thomsonis,* with *Pheronema carpenteri* also occasionally colonizing some areas. Apart from this, sponge assemblages were mostly composed by more disperse colonies of the species *Macandrewia azorica, Poecillastra compressa* and *Haliclona implexa.* Among the coral species observed during the day there are the yellow morphotype of the whip coral *Viminella flagellum,* some colonies of the genus *Acanthogorgia* and the scleractinian *Dendrophyllia cornigera.* We also drifted over some small deeps-sea sharks (*Dalatias licha* and *Daenia* sp.), and some fishes (*Mora moro* and *Phycis pyhcis*). We headed towards Velas harbour to refuel at around 15h00. After refuelling we transited back to Horta, where we arrived at around 18h00.

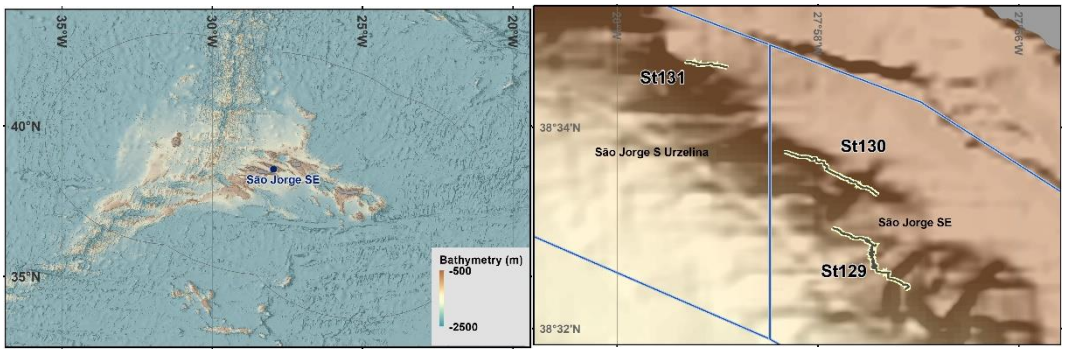


Figure 89. Location of São Jorge SE and S Urzelina and the dives conducted with the Azor drift-cam in these areas, 3rd August 2023.

Figure 90. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Jorge SE and S Urzelina, 3rd August 2023.

4-6, and 9 August 2023

On the 4th of August, we unloaded, cleaned, and serviced all our equipment. During the days 5, 6 and 9 of August we tested the SeaTrac - Blueprint Subsea USBL system, an equipment we acquired to reduce the positioning error of the Azor drift cam relative to the vessel from which it is operated. Putting the USBL system to work was a challenge and, even after many contacts with the assistance and several tests at sea, the positioning system still showed a great error. For its correct deployment more tests were required, however the next leg on board the MT Physeter was about to start. Therefore, we decided to postpone the deployment of the USBL system and not to use it in MapGES 2023. Among many other things, we also put together a completely new umbilical.

2.5 REPORT OF THE MT PHYSETER LEG 5

The Azores deep-sea research group made extensive efforts to bring the Portuguese Research Vessel "Mário Ruivo" to the Azores to continue exploring the deep-sea benthic habitats of this region. Unfortunately, after a long period of negotiations, the owner of the vessel informed us that it was not possible to pursue said scientific campaign. The lack of legal certifications along with logistic problems made this plan impossible. To overcome such a bad outcome, we decided to send the RV Arquipélago to explore those areas that were allocated to be surveyed with the RV Mário Ruivo (e.g., Hard Rock Café and Kurchatov seamount) and to send MT Physeter to explore the slopes of São Miguel Island. Leg 5 of the MT Physeter cruise, therefore, aimed to conduct a rapid appraisal of the deep-sea benthic communities dwelling on São Miguel Islands' slopes.

2.5.1 Summary of MT Physeter Leg 5

Objective: to conduct a rapid appraisal of the deep-sea benthic communities dwelling on island slopes and seamounts around São Miguel Island on board of the MT Physeter. 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 81 dives with the Azor drift-cam down to 997 m depth, covered 44.45 km of seafloor and collected 77.93 hours of video footage.

Vessel: MT Physeter

Dates: 15 August – 15 September 2023

Scientific team: Gerald Taranto (chief scientist), Laurence Fauconnet (chief scientist), João Balsa, Inês Bruno, António Godinho, Alexandra Rosa, Alexandre Morais, Nicolás Collazo, Isabel Areosa, Marc Pladevall and Telmo Morato.

Figure 91. The three scientific teams on the MT Physeter that participated in the Leg 5 of the MapGES 2023 cruise.

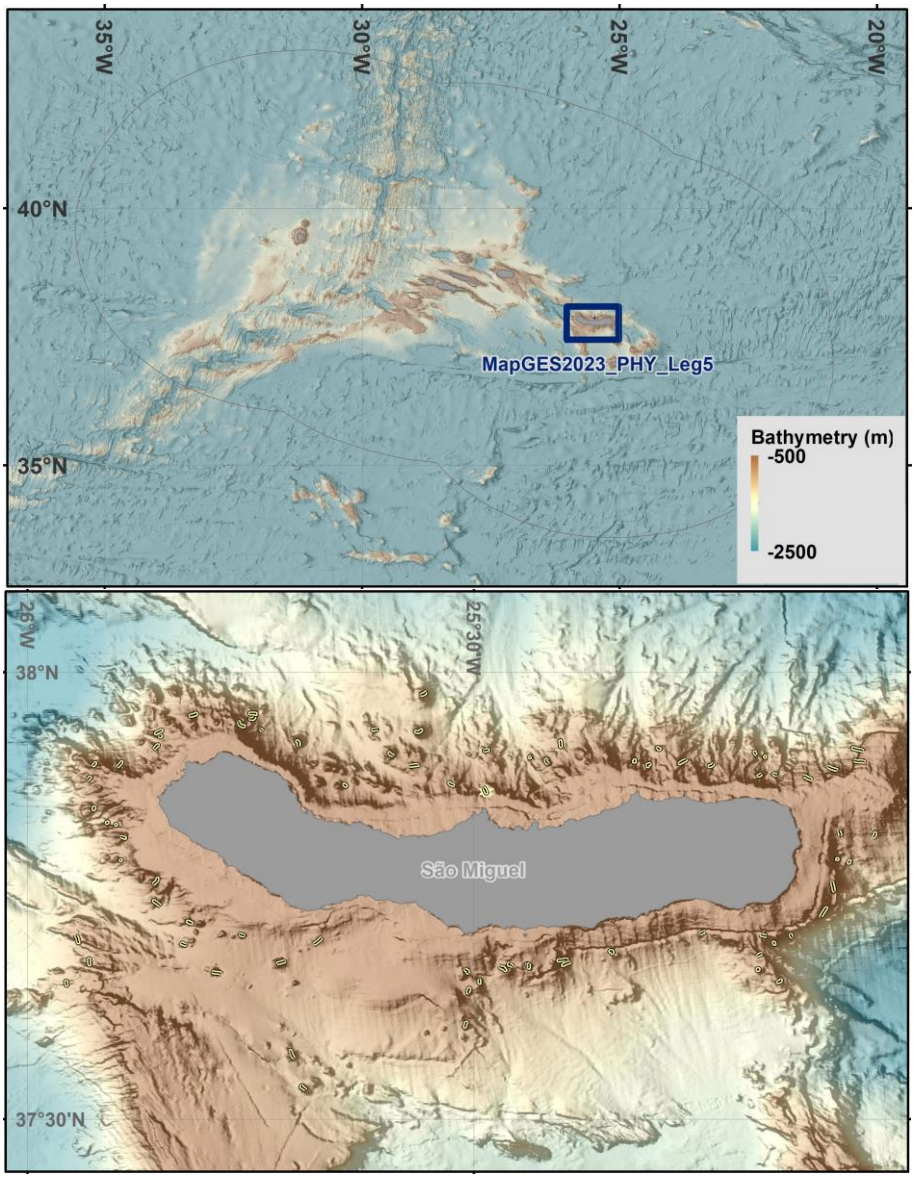


Figure 92. Location of the 81 video transects (black lines) carried out with the Azor drift-cam during Leg 5 of the MapGES 2023 cruise on board the MT Physeter.

Figure 93. Screenshots taken from the footage recorded during Leg 5 of MapGES 2023 cruise. (a) Coral aggregation mainly composed of large yellow colonies of *Dentomuricea* aff. *meteor* and orange colonies of *Acanthogorgia* spp. (b) Outcrop colonized by the whip coral *Viminella flagellum*. Note the presence of soft sediment even on step outcrops suggesting high deposition rates in this area. (c) Coral garden featuring, among others, the bubblegum coral *Paragorgia johnsoni* (white and red morphotypes) and one colony of *Callogorgia verticillata*. (d) Very dense garden dominated by the primnoid coral *Callogorgia verticillata*. (e) Seafloor entirely covered by a reef constructed by the yellow looking stony coral *Eguchipsammia cornucopia*, the primnoid *Narella versluysi*, other coral species and a swallowtail sea perch (*Anthias anthias*) swimming by. (f) Vertical wall presenting many fragments of the invasive algae *Rugulopteryx okamurae* covering small gorgonian corals. (g) Rocky outcrop completely colonized by several sponge species and several lost fishing gears. (h) Colonies of the long-lived black coral *Leiopathes expansa*. (i) Ray of the species *Dipturus intermedius* laying on the seafloor. (j) A possible new deep-sea fish species for the Azorean archipelago *Gaidropsaurus* sp.

2.5.2 Cruise diary of MT Physeter Leg 5

15 August 2023

After two weeks of preparing the material since the last leg around São Jorge Island, we spent the morning doing the last arrangements and loading the MT Physeter with the necessary gear for this next leg of deep-sea exploration with the Azor drift-cam. The vessel and its crew left Horta harbour at 15h00 and arrived at Rabo de Peixe harbour (São Miguel Island) around mid-night, after about 150 nm and an approximately 9-hour long trip. For a matter of comfort, the scientific team travelled by plane, from Pico Island because there were no flights available from Faial Island. After the arrival, we took care of the necessary logistics and settled at our base for the next week, in Calhetas. At night, we had a welcome dinner in the restaurant "Associação Agrícola de São Miguel". Unfortunately, our team member António Godinho had his flight cancelled and could only join us on the following day.

Figure 94. View of Pico Mountain from the aircraft that transported part of the team to São Miguel Island.

16 August 2023

The MT Physeter was refuelled before leaving the harbour for the first day of deep-sea explorations ever in São Miguel Island. This process took longer than expected, therefore, we could only leave Rabo de Peixe at 10h30 and start the first dive of the day at 11h30. We performed a total of 4 dives, between 280 and 940 m, in São Miguel N area. Throughout the day we had several little problems with the equipment, a situation always expected on the first day of mission. The converter "AV2HDMI" had to be replaced before the first dive and during the same dive, water entered in the housing of the GitUp. We changed one of the O-rings but unfortunately, this did not solve the problem, so we opted to change the cap of the housing in dive three solving the issue. Finally, the cap with 2 sets of 4 pins that cover the cylinder of led and laser battery was not working. This element was replaced right before the third dive. These problems did not cause any major delay in the operations, but water was visible in the GitUp recordings of the first dive and the GitUp did not record any video of the second dive. Fortunately, the GoPro worked properly so we have video footage for the visited stations. Overall, the drifts throughout the day followed the desired course, although in the last 3 dives the help of the

skipper was necessary to do some adjustments because the wind was getting stronger and the waves bigger, pushing our structure slightly out of the expected route.

All dives started with a sandy bottom progressively changing into rocky grounds as the cam system moved up the banks. In some areas it was also possible to find patches of coral rubble. During the first part of the dives, we encountered generally low biodiversity and abundance, characteristic of sedimentary bottoms, such as: *Flabellum* spp. and *Lytocarpia myriophyllum*. At locations with basaltic outcrops, we found a considerable number of coral species like: *Acanthogorgia* spp., *Viminella flagellum, Narella bellissima* and *N. versluysi*, *Callogorgia verticillata, Acanella arbucula* and unusually big specimens of *Dentomuricea* aff. *meteor.* We also observed a big variety of sponges such as, *Regadrella phoenix, Characella pachastrelloides* complex, *Petrosia crassa*, *Pheronema carpenteri* and others. Finally, we noticed several fish species such as the bluemouth rockfish (*Helicolenus dactylopterus*), *Mora moro, Lepidorhombus whiffiagonis* and some individuals of the family Macrouridae and the genus *Chaunax*. During the dive at St133 we encountered one *Lophius piscatorius* laying on the sand. After the last dive, we headed back to Rabo de Peixe harbour, where we arrived after a 30-minute transit, at 20h00. On the trip back to the harbour, the sea started to be a bit rough.

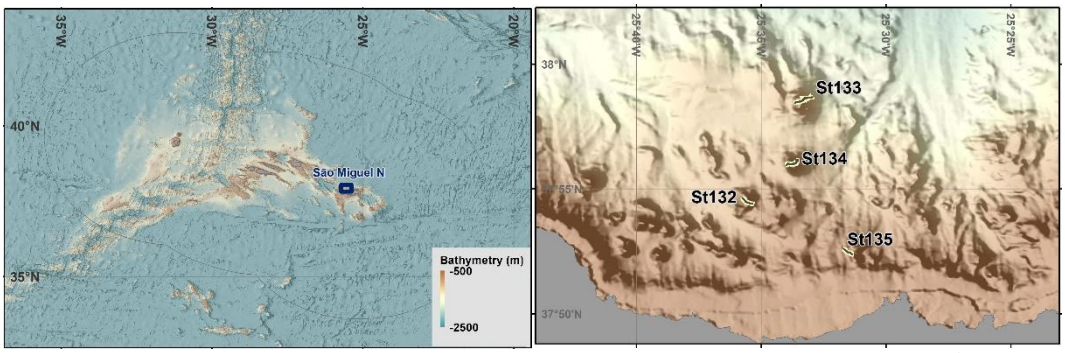


Figure 95. Location of São Miguel N and the dives conducted with the Azor drift-cam in this area, 16th August 2023.

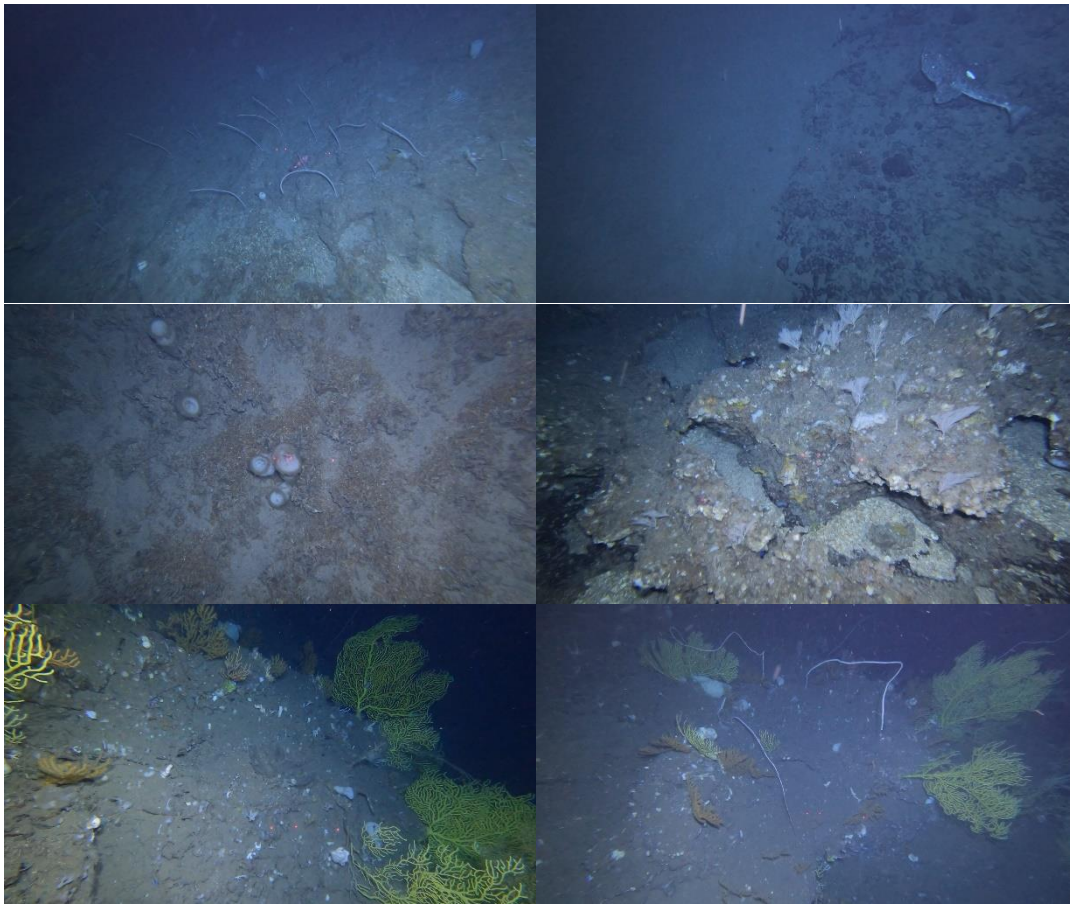


Figure 96. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel N, 16th August 2023.

17 August 2023

After a slightly challenging end of the previous day, due to rough sea conditions, and with an even worse weather forecast for the day, we decided not to take unnecessary risks and stayed on land. During this day we took the opportunity to work on the mission report, do preliminary analysis of the recorded videos and fix some of the equipment that got damaged on the previous day.

18 August 2023

Even knowing that the sea conditions were not optimal, we decided to give it a try and left Rabo de Peixe harbour around 10h20 (the weather was supposed to improve late in the morning). Unfortunately, we had to head back 15 minutes later because the sea was still too rough to operate the Azor drift-cam or even to have a safe trip with the boat with very heavy swell and fast drift. We waited in the port for a while and had lunch, hoping that the better forecast for the afternoon turned out to be true. We also took the opportunity to fix some material and do some more thorough maintenance. To solve the problem of the cap of the cylinder of the laser and led battery, we had to buy another soldering iron because the old one broke during the transport from Faial to São Miguel. After a significant improvement in the weather conditions, we set sail to our first station arriving at approximately 13h55. We completed a total of 4 dives, between 296 and 906 m depth. Three dives were in São Miguel NE, and one in São Miguel N. The third dive (St138) was interrupted because the drift was taking us into very deep areas, jeopardizing the safety of the dive and the equipment itself. All remaining

dives had good drifts taking the Azor drift-cam along the desired transects across banks and seamounts. During the afternoon of work, no technical problems were noticed, and all dives went without incidents, with the only note being that the GoPro camera switched off unexpectedly in the middle of the third dive.

In all dives, the structure landed on sandy bottoms, that progressively changed into rocky bottoms with a substantial coverage of sand and with some basaltic outcrops, and small walls. Coral rubble was seen on the floor during the last dive (St139). A huge ball of krill followed the structure during the first dive (St 136), making the navigation very challenging. Overall, we drifted over some coral species such as *Acanthogorgia* spp*., Callogorgia verticillata, Viminella flagellum, Dentomuricea* aff. *meteor*, being these last two composed of large individuals. It was possible to observe a high abundance of *Lytocarpia myriophyllum* specimens on sandy bottom. Sponges were mainly composed of specimens of *Characella pachastrelloides* complex, *Petrosia crassa,* and an unusually big abundance of individuals of *Geodia* spp. We also found some fishes, for example, *Lepidorhombus whiffiagonis, Trachyscorpia cristulata* and the commonly spotted *Helicolenus dactylopterus.* Still regarding fauna, we also drifted over a *Cancer bellianus* and a *Paramola Cuvieri* carrying a sponge. The last dive of the day was characterized by the constant presence of some species of Ctenophores. Before heading back to Rabo de Peixe, we were visited by two beaked whales and enjoyed a beautiful sunset. We arrived at the harbour at around 21h00.

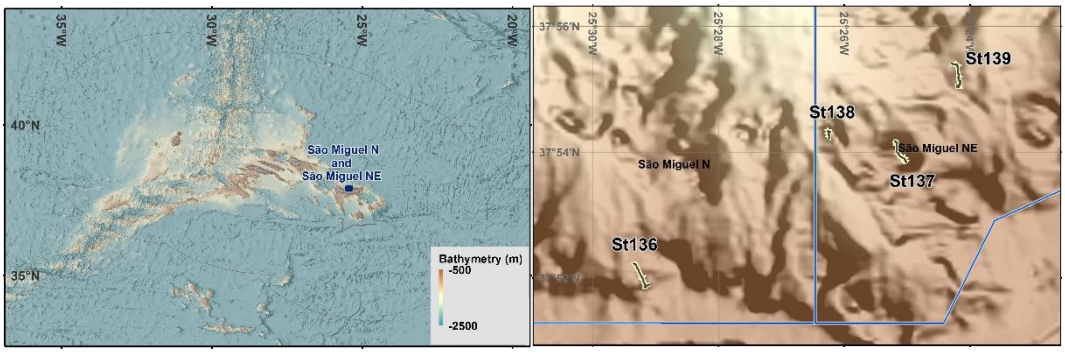


Figure 97. Location of São Miguel N and NE and the dives conducted with the Azor drift-cam in these areas, 18th August 2023.

Figure 98. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel N and NE, 18th August 2023.

19 August 2023

We left the harbour around 8h30, heading toward São Miguel NE, and after one hour of navigation we reached our first station. We performed a total of 5 dives, between 277 and 724 m. All dives were characterized by large areas of sandy bottom, even on steep areas, suggesting a strong sedimentation that possibly limits the substrate available for coral and sponges to settle. By the time we arrived it was slack tide and the wind was light, making it very difficult to foresee the drift of our camera system. Therefore, the first dive (St140) covered a short distance, and the drift did not go as expected. This dive was entirely characterized by a sandy bottom. The remaining dives showed better drifts and the explored seafloor transitioned slowly from sandy bottoms to some patches of coral rubble and then to rocky bottoms, with some basaltic outcrops covered with small life such as encrusting sponges, soft corals, and hydrozoans. Among all the dives performed during the day, the second one presented the richest diversity of benthic organisms. During this dive, we observed several sponge species, such as *Pakellia ventilabrum, Characella pachastrelloides* complex, one specimen of a blue *Leiodermatium* sp., and a spread but large area of *Pseudotrachya hystrix*. We also observed some coral species such as large colonies of *Viminella flagellum*, and small colonies of *Callogorgia verticillata* and *Dentomuricea* aff. *meteor.* The remaining stations showed a lower megafauna diversity. In the first dive we only spotted one genus of coral characteristic of soft sediments (*Flabellum* spp.), and fishes from the Macrouridae family. In this dive, the drift-cam was followed by a ball of krill making the navigation complicated at some points. In general, fishes from the Macrouridae family and *Helicolenus dactylopterus* were common to all dives. There was a noteworthy amount of *Ceriantharia* colonizing the sandy grounds. After leaving the last diving spot, we reached the harbour at

19h20, where we had to fix the metallic structure that protects the drift-cam system. We left the vessel at 20h00 and headed home to rest.

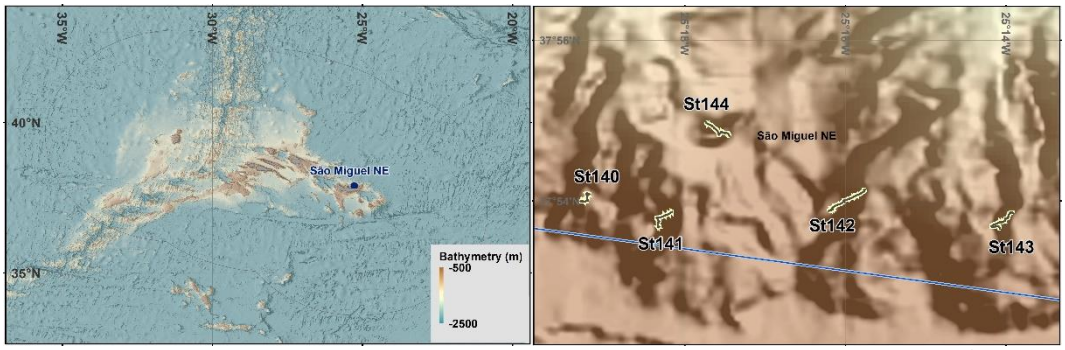


Figure 99. Location of São Miguel NE and the dives conducted with the Azor drift-cam in this area, 19th August 2023.

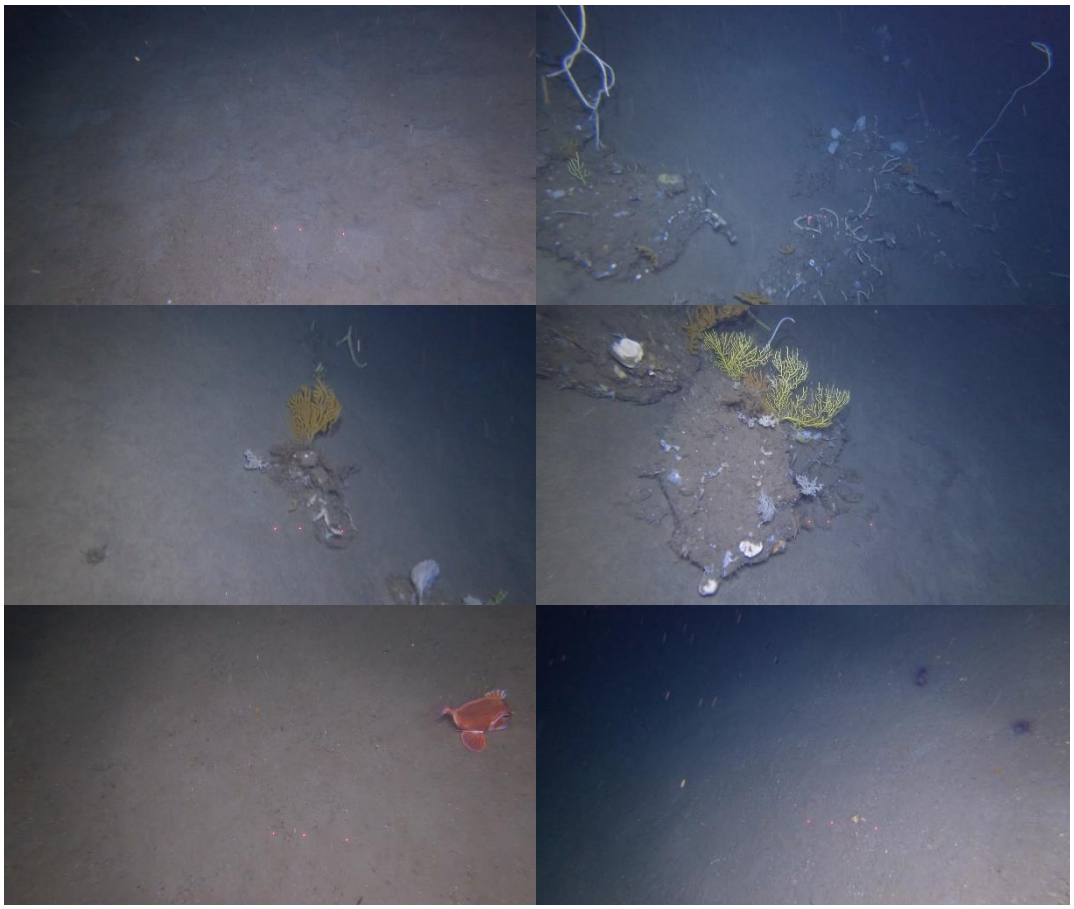


Figure 100. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel NE, 19th August 2023.

20 August 2023

We left Rabo de Peixe at 08h10 in the direction of São Miguel NW and, after 30 minutes of navigation, we reached the first station. We decided to remain within 15 nm from the harbour (about 1 hour of navigation) because local authorities issued a yellow warning due to storms and heavy showers forecasted between the days 20 and 21 of August. We started our operations at around 08h58 and, in total, we completed 4 dives between 399 and 947 m depth. We attempted a fifth dive (St149), but we decided to abort it due to rough

weather conditions that made it impossible to safely operate our camera system. In fact, while we had an acceptable weather during the first four dives (although it was raining heavily around midday), the wind became very strong in the late afternoon.

The first two dives (St145-146) had a good drift and navigation and covered a long distance. The navigation became harder in the third (St147) and fourth (St148) dives because of strong winds and currents that made it challenging to keep the camera system close to the seafloor. The drift was good in St147, while it only partially followed the expected direction in St148. In general, the explored seafloor was characterized by the presence of basaltic outcrops, sometimes covered with sand. From all the deployments we performed that day, the most amazing in terms of fauna was the second dive (St146) where we discovered rocky bottoms with an unusually high abundance of *Narella bellissima* and *N. versluysi* colonies. During this dive it was also possible to observe specimens of the two different morphotypes of *Paragorgia johnsoni*, which are quite rare in the Azores region, even more so in the quantity observed. In general, this dive showed a great diversity of coral species that formed very dense and extensive coral gardens. These gardens also included, among others, the following species: *Callogorgia verticillata, Acanthogorgia* spp*., Pleurocorallium johnsoni* and *Stichopathes gravieri*. Curiously, we made another dive (St147) 600 m away from St146 on an area of similar depth and geomorphology, but the recorded fauna was different, with levels of coral richness and abundance substantially lower than the levels recorded in St146. Overall, the highest abundances and diversity of corals and sponges were detected at bottoms covered with basaltic outcrops and coral rubble. During the dives of the day, we recorded many sponge species including *Phakelia ventilabrum, Macandrewia azorica, Farrea occa* and *Characella pachastrelloides* complex. The most commonly observed fishes were the often spotted *Helicolenus dactylopterus*, large shoals of *Capros aper* and a *Halosaurus* sp. After aborting our last dive, we decided to call it for the day and headed back to Rabo de Peixe harbour where we arrived, after a bumpy navigation, at 19h00. A very strong storm hit São Miguel during the early evening hours, giving us a beautiful lightning show.

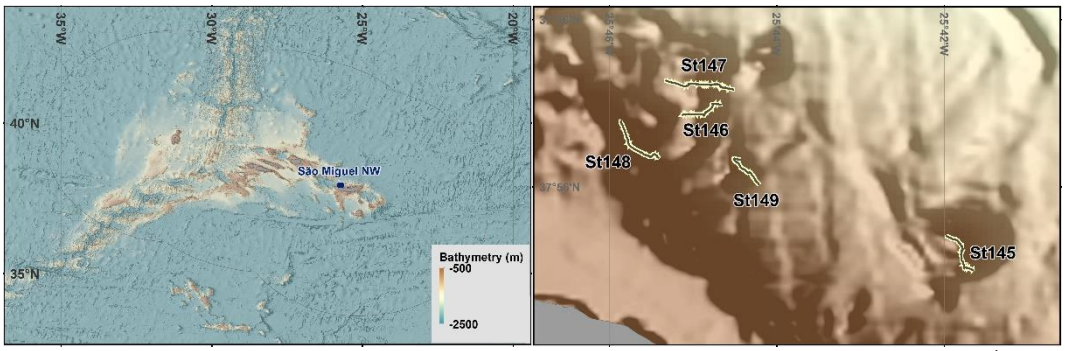


Figure 101. Location of São Miguel NW and the dives conducted with the Azor drift-cam in this area, 20th August 2023.

Figure 102. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel NW, 20th August 2023.

Figure 103. Photo of the intense thunderstorm that hit the northern part of São Miguel Island during the late afternoon and night.

21 August 2023

After a night of heavy rain and thunderstorms, sea conditions were quite rough on the morning of the 21st of August. Nevertheless, we decided to leave the harbour of Rabo de Peixe to assess first hand whether it was possible to work with our camera system. Before leaving the harbour, we had to wait for the MT Physeter to be refuelled which was only possible at 09h30. By the time we arrived at our sampling site (10h30), sea conditions got even worse. After a brief discussion between the scientific team and the skipper, it was decided that it was not safe to deploy and operate the Azor drift-cam and the only option left was to head back to the harbour where we arrived, after a rough navigation, at 12h00. During the trip we realized that the micro-USB cable that feeds the GitUp camera was damaged, so we had to replace it. We had lunch with the crew of the MT Physeter at the restaurant "Faria" in Ribeira Grande to discuss about the weather forecast for the upcoming days, which looked quite complicated. All together we decided that, based on the weather forecast, it was impossible to work on the northern side of São Miguel and that the best bet for the following days was to move our operations to the southern side of the island, an area that was better sheltered from the incoming winds. We spent one hour preparing the ship for navigation, securing all our equipment in order not to be damaged during the transport. The MT Physeter and his crew started their journey toward Vila Franca do Campo at about 16h00. After a transit of about 40 nm, they arrived at the harbour of Vila Franca do Campo at 19h50.

22 August 2023

After a day on land, we got ready to start our operations off the southern coast of São Miguel. We left our base in Calhetas a bit earlier than 8h00 to meet the Physeter crew at the harbour of Vila Franca do Campo for a short briefing. The sea was not in optimal conditions, with moderate to strong wind and swell, so we decided to remain within a short distance from the harbour. We started our operations at 9h18 and, in total, we completed 6 dives between 310 and 634 m depth in São Miguel S. The first dive (St150) was very hard to navigate, with strong currents making it challenging to keep the Azor drift-cam close to the seafloor. In Figure 104 it is possible to see how strong current and drift were by looking at the wide angle between the winch and the umbilical holding our camera system. Because of these demanding conditions, we decided to limit our operations to depths shallower than 600 m, where it is easier to operate the Azor drift-cam in rough sea conditions. However, at these depths, the presence of lost fishing lines was a constant. Fortunately, and due to the dexterity of our team, we did not get entangled in any of them. Despite all the challenges, there were no technical problems during this day. The drifts of St150, St152, and St155 did not follow entirely the expected course, with our camera system moving on a moderate downslope characterized by soft sediment. Because of the sea condition, it was not possible for the skipper to help us correct the course of our camera system. Sedimentation seemed strong at all visited sites, even in areas of steep slopes where basaltic outcrops were barely visible. *Callogorgia verticillata* specimens were found in several of the visited sites, particularly large, frequent, and dense at St153. Besides *Callogorgia verticillata*, many other coral species were found at this station, with *Acanthogorgia* spp., *Viminella flagellum,* and *Dentomuricea* aff. *meteor* being the most common. During all dives there was a significant presence of sponge species, in particular of *Petrosia crassa*, *Phakelia ventilabrum,* and *Characella pachastrelloides* complex. We also observed some fauna, in particular a *Conger conger* in a rock crack, many specimens of *Halicolenus dactylopterus* and shoals of *Capros aper*. Interestingly, in most dives many fragments of the invasive alga *Rugulopteryx okamurae* were visible, rolling on the seafloor. The weather worsened after the last dive of the day, therefore we decided to end our operations at around 18h15 coming back to Vila Franca do Campo harbour at 19h00 and finally back to our base in Calhetas half an hour later.

Figure 104. The umbilical of the Azor drift-cam showing a very wide angle on the winch. This is indicative of strong drift and/or strong bottom currents, 22 August 2023.

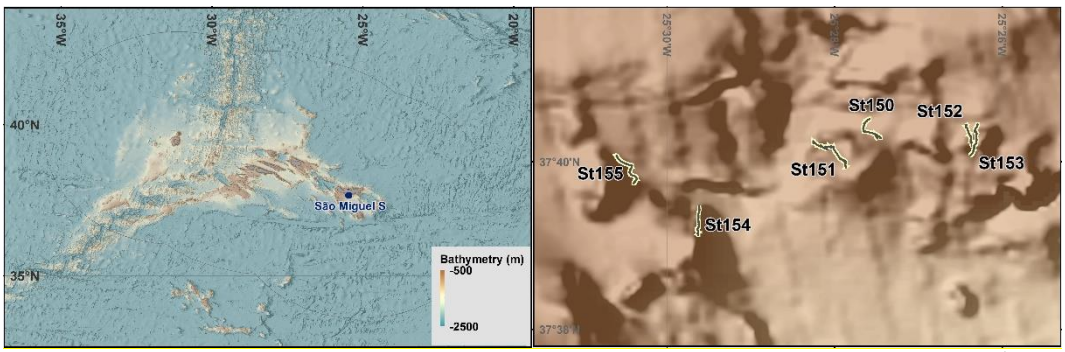


Figure 105. Location of São Miguel S and the dives conducted with the Azor drift-cam in this area, 22nd August 2023.

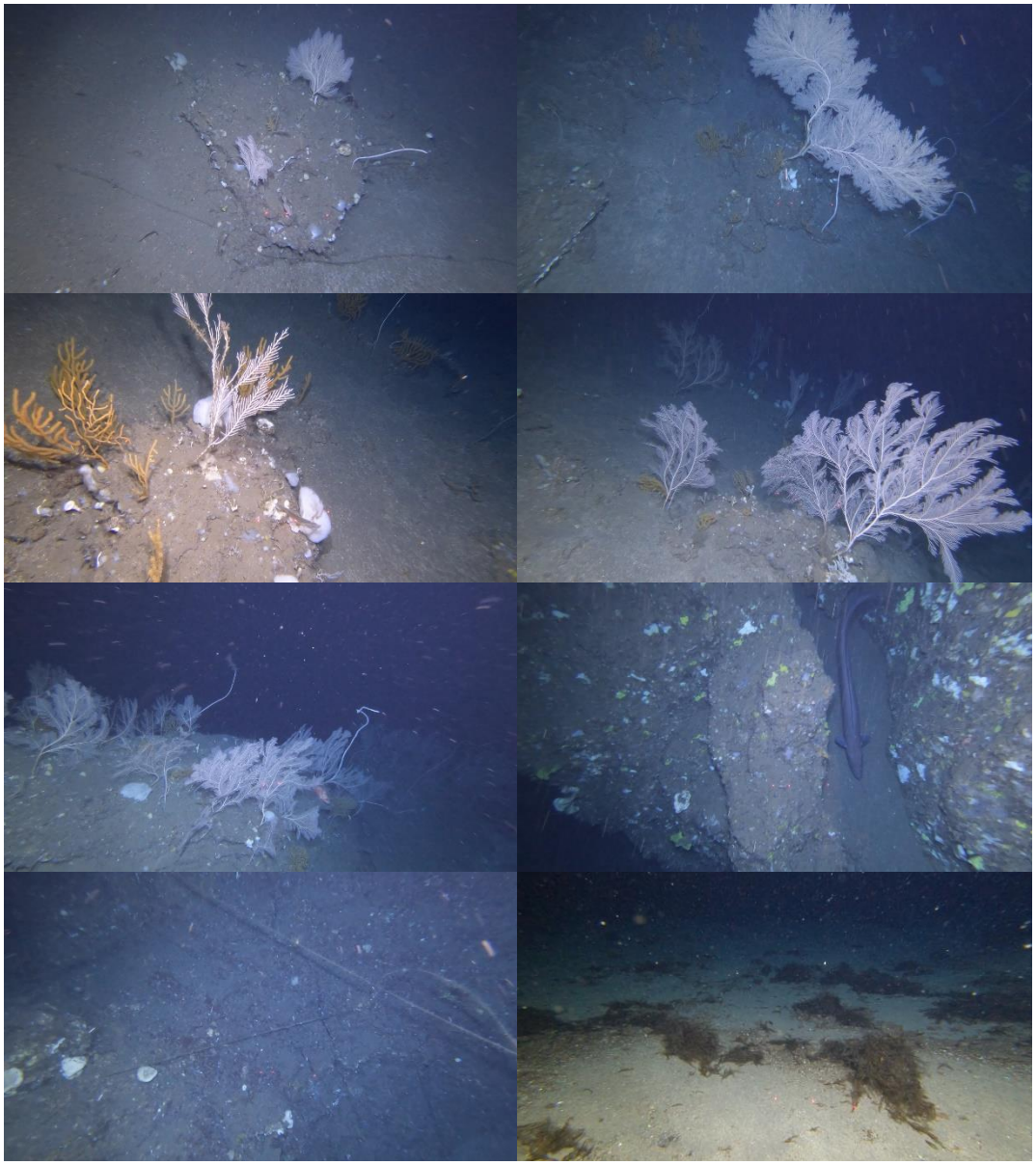


Figure 106. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel S, 22nd August 2023.

23 August 2023

The refuelling operations could only be scheduled at 09h30, therefore, we only managed to leave the harbour of Vila Franca do Campo at 09h50. On this day, we welcomed the new skipper of the boat, Pedro, that arrived to substitute our main skipper, Bruno, that had to leave for personal reasons. Bruno and Pedro worked together for a couple of days for Pedro to see how our camera system was operated and what was expected from him. The weather forecast for this day was promising, with an expected reduction of wind strength and swell amplitude. Based on this forecast we opted to visit an area a bit further away from the main ports, São Miguel W. This area was better suited than other areas South of São Miguel to take advantage of the winds blowing from the North, with expected drifts going South. In total, we did 5 dives between 373 and 869 m, four in São Miguel W and one in São Miguel SW. By the time we arrived at our first station of the day (11h15), sea conditions were good, with moderate swell and wind. Our first dive (St156) followed the expected course and showed good drift and navigation. This encouraged us to navigate a bit further offshore to perform a deeper dive.

Unfortunately, weather conditions worsened very quickly, and by early afternoon, sea conditions became rough, with 1.5 to 2 meters waves and strong wind. All our attempts to go below 500 m depth (St157, 158, and 160) did not produce the expected result with unpredictable drifts, mostly moving downslope on soft substrate. At stations 157 and 158, bottom currents were so strong that our camera system was always pushed back to the base of the bank we were trying to explore, even against the dominant wave and wind direction (North). Sadly, all these dives had to be aborted. The fourth dive of the day (St159, 473 m depth) followed the expected drift. Despite the challenging weather conditions, there were no technical problems with the Azor drift-cam. Sandy bottoms were predominant at all visited sites, with only St156 and St159 showing basaltic outcrops. At St156 a krill swarm followed our camera system for most of the dive. During the dives, we observed several large colonies of *Viminella flagellum* and *Callogorgia verticillata*, and some individuals of *Acanthogorgia* spp. Besides these species, we also noticed a few specimens of *Lytocarpia myriophyllum*, *Dentomuricea* aff. *meteor* and one specimen of *Paracalyptrophora josephinae*. It was possible to see several types of sponges including *Characella pachastrelloides* complex, *Haliclona implexa*, *Macandrewia azorica*, and a considerable amount of *Phakellia ventillabrum* and *Neophrissospongia nolitangere* attached to rocky grounds. Just like in previous dives, shoals of *Capros aper* tended to follow our camera system. We also filmed an abundant shoal of Atlantic horse mackerel (*Trachurus trachurus*). We recorded one specimen of arrowhead dogfish (*Deania profundorum*) and a *Paramola cuvieri* was observed carrying a sponge fragment. Fragments of the invasive alga *Rugulopteryx okamurae* were visible at almost 900 m depth. After a very rough day, we decided to stop in the harbour of Ponta Delgada which was closer to our sampling site than Vila Franca do Campo and appeared to be more sheltered and better located to execute our working plan for the following day (visit São Miguel SW). We arrived at the harbour at 19h30, after one hour of navigation.

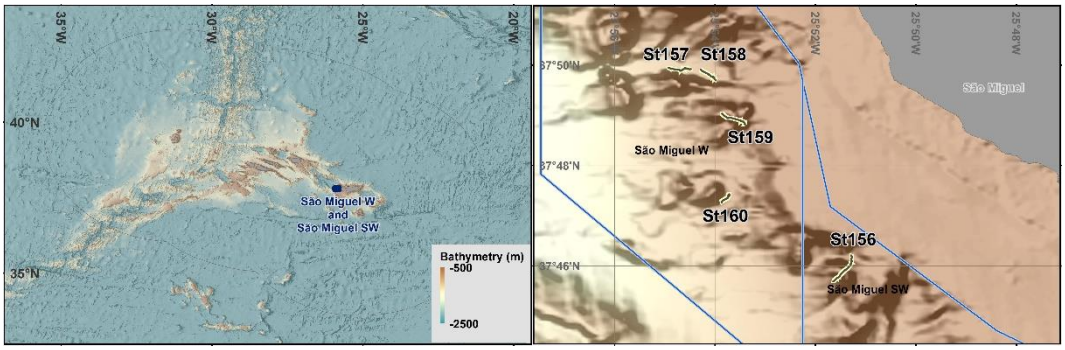


Figure 107. Location of São Miguel W and SW and the dives conducted with the Azor drift-cam in these areas, 23rd August 2023.

Figure 108. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel W and SW, 23rd August 2023.

24 August 2023

Based on the experience of the previous day and considering an even worse forecast for the day, we decided to remain in the vicinity of Ponta Delgada harbour, in São Miguel SW. We left the harbour at 8h30 and arrived at the first station (St161) half an hour later. Once arrived we checked how the boat was drifting before starting our operation at 09h26. The first dive was accompanied by strong winds blowing from east-northeast, big swell and fast bottom currents, but overall, the transect went well with good navigation and drift. By the end of the first dive, weather conditions worsened, jeopardizing our capacity to safely operate the Azor drift-cam. Therefore, we opted to move even closer to shore, to a shallow site of about 350 m depth where we realized a second dive. On the deck of the MT Physeter, conditions were very rough, nevertheless, all crew and scientific members did their best to conclude the dive, that was showing good drift and navigation. After the dive, the chief scientist and the skipper decided that it was not safe to attempt a third dive. We returned to the harbour at 13h30 where we had lunch, assessed the weather conditions, and studied the forecast. Unfortunately, it was not possible to go out at sea and work safely that afternoon. We headed back to our base in Calhetas and worked on the mission report and the preliminary analysis of the recorded videos.

In total, we performed 2 dives, between 349 and 536 m depth. In both dives, we navigated through some sandy bottoms, coral rubble, and sporadic basaltic outcrops and boulders that hosted the majority of the detected fauna. This fauna was mainly composed of the coral species *Viminella flagellum*, relatively large and spread colonies of *Callogorgia verticillata*, with occasional colonies of *Dentomuricea* aff. *meteor* and *Acanthogorgia* spp. Our gift for enduring such rough conditions throughout the morning was a very extensive reef of *Eguchipsammia cornucopia* present during one dive. This species is quite rare in the Archipelago of the Azores.

Among other coral species, we can mention the black coral *Parantipathes hirondelle* and the stony coral *Flabellum* sp. found laying on sandy bottoms. Concerning the phylum Porifera, the most common species were: *Characella pachastrelloides* complex (relatively big specimens), *Neophrissospongia nolitangere, Macandrewia azorica* and some individuals of two morphotypes of the genus *Leiodermatium* (white and blue). We also drifted over fauna, namely fish and shark species such as: *Lepidorhombus whiffiagonis*, *Conger conger* or *Dalatia licha*, and it is also worth mentioning some crustacean species like *Paramola cuvieri*, observed carrying a piece of the coral *Callogorgia verticilata*.

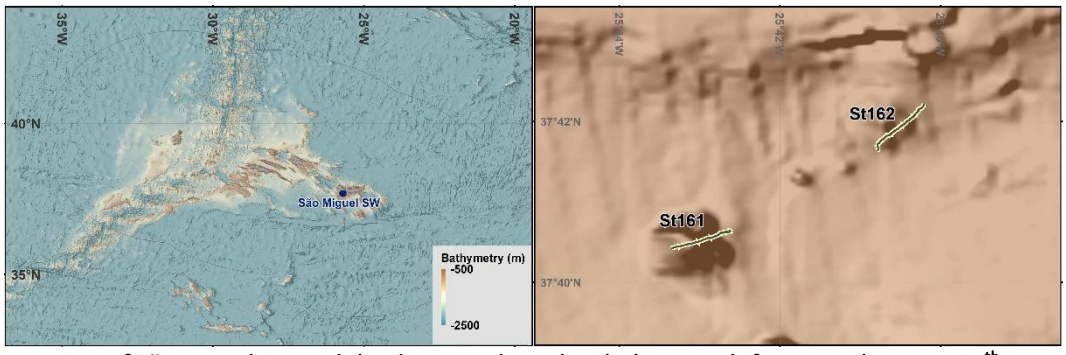


Figure 109. Location of São Miguel SW and the dives conducted with the Azor drift-cam in this area, 24th August 2023.

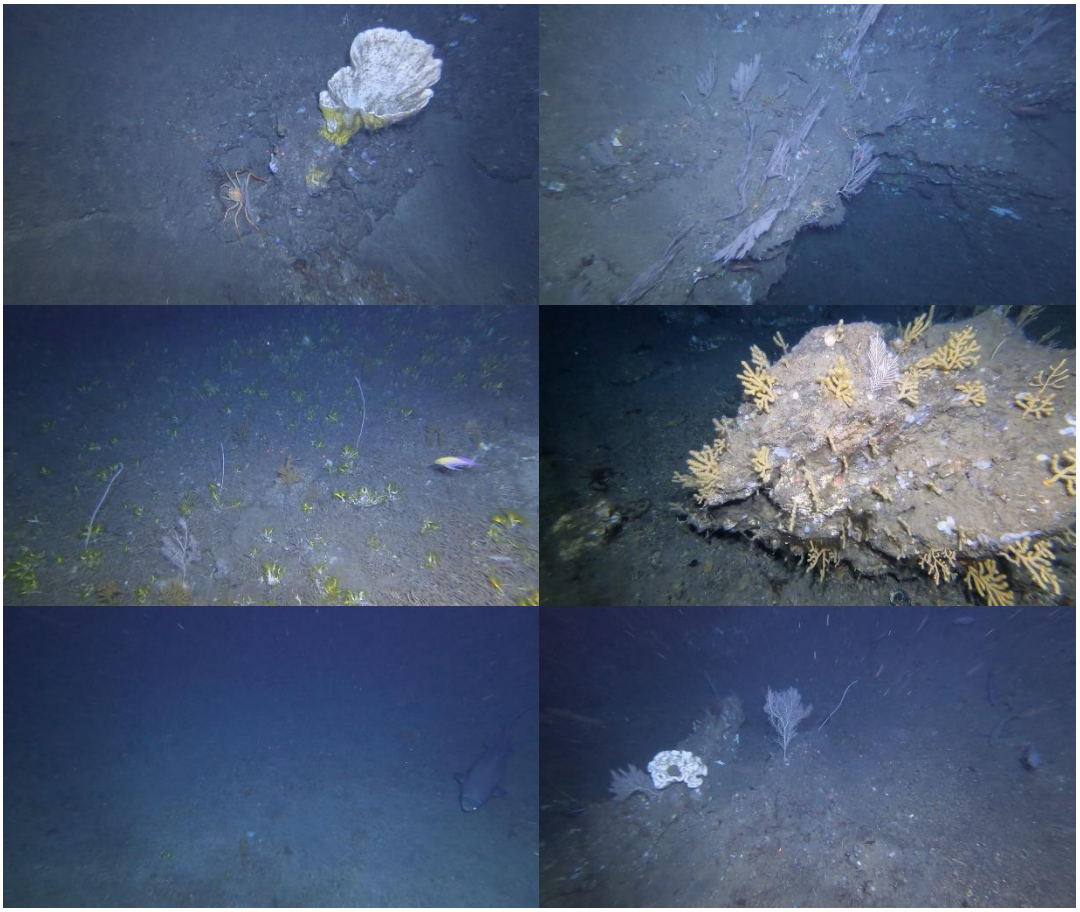


Figure 110. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel SW, 24th August 2023.

25 August 2023

The weather forecast for the 25th of August predicted weak winds in the early morning with conditions getting progressively worse throughout the day. Therefore, we decided to take advantage of that small window of good weather and started the day a bit earlier than usual, leaving Ponta Delgada at around 07h15. We sailed toward the most sheltered area of São Miguel (São Miguel S), reaching our first dive site off Vila Franca do Campo at 08h34. We performed 3 dives during the day, between 333 and 684 m. The first dive (St163) was by far the best in terms of sea conditions, drift, and navigation. Although we climbed up the island slope from about 600 to 350 meters, the seafloor at St163 was mainly covered by sand and hosted very little abundance of benthic megafauna. The second dive (St164) was much more challenging in terms of drift and navigation, and constant help from the skipper was required in order to slow down our drift and avoid the lifting of our structure from the seafloor. Nevertheless, the drift was good and went as expected. After the second dive, we made a small pit stop in the harbour of Vila Franca do Campo, where we had lunch and waited for the tide to turn, hoping that this could facilitate the operations with our camera system. Unfortunately, in the afternoon we could only perform one dive (St165) because the easterly winds became too strong, continuously pushing the line of the Azores drift-cam toward the stern of the boat, very close to the engine. Again, besides all difficulties, the drift of the last dive was good and went as expected. Nevertheless, there was no way to keep working in such conditions without compromising the safety of the boat, of the equipment and of the people on board, hence, after the end of the dive we moved back to Ponta Delgada, where we arrived at 16h15.

This was a troublesome day for our equipment. At the end of the second dive, while recovering the drift-cam, we lost the weight that keeps our structure close to the seafloor. In the middle of the third dive the current was so strong that the line and the electrical cable that transmits the signal of the live view were overly stretched. This tension caused a rupture in one of the wires of the electrical cable, and, in turn, the loss of the live view. We were forced to end the dive prematurely. Finally, we forgot to redeploy the depth and temperature sensor "StarOddi" after lunch, so we do not have environmental data for St165. Most of the dives performed during the day were on soft substrates with the occasional presence of basaltic boulders and vertical walls. The benthic megafauna observed was not very abundant and diverse. *Acanthogorgia* spp. seemed to be the most common coral along with cf. *Pleurocorallium johnsoni* and *Pseudoanthomastus* spp. A few *Stichopathes gravieri* specimens were also spotted on rocky bottoms, along with some hydrozoans and on sandy grounds we observed a few *Flabellum* spp. Sponges were the most frequent sessile fauna found during all dives with species such as *Phakellia ventilabrum*, *Farrea occa,* and *Spongosorites coralliophaga* inhabiting mostly rocky grounds. fauna was composed by *Paramola cuvieri*, *Cancer bellianus,* the usual presence of *Capros aper* and some fishes from Macrouridae family. One more time, and mainly at St165, seafloor patches covered by fragments of the invasive alga *Rugulopteryx okamurae* were very common.

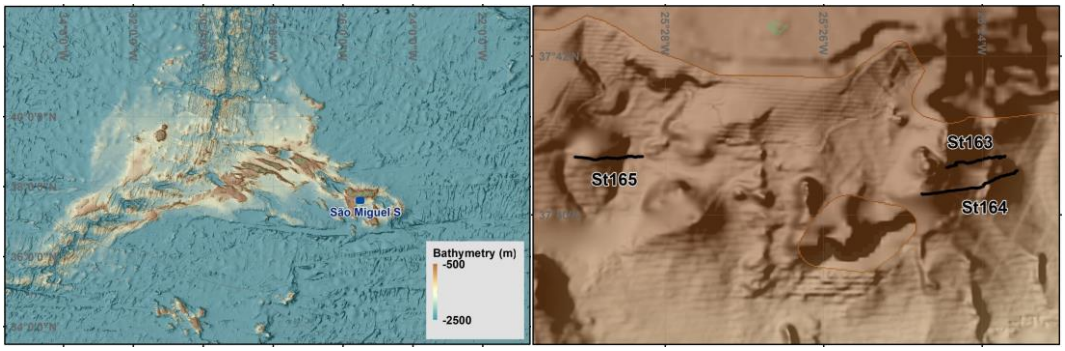


Figure 111. Location of São Miguel S and the dives conducted with the Azor drift-cam in this area, 25th August 2023.

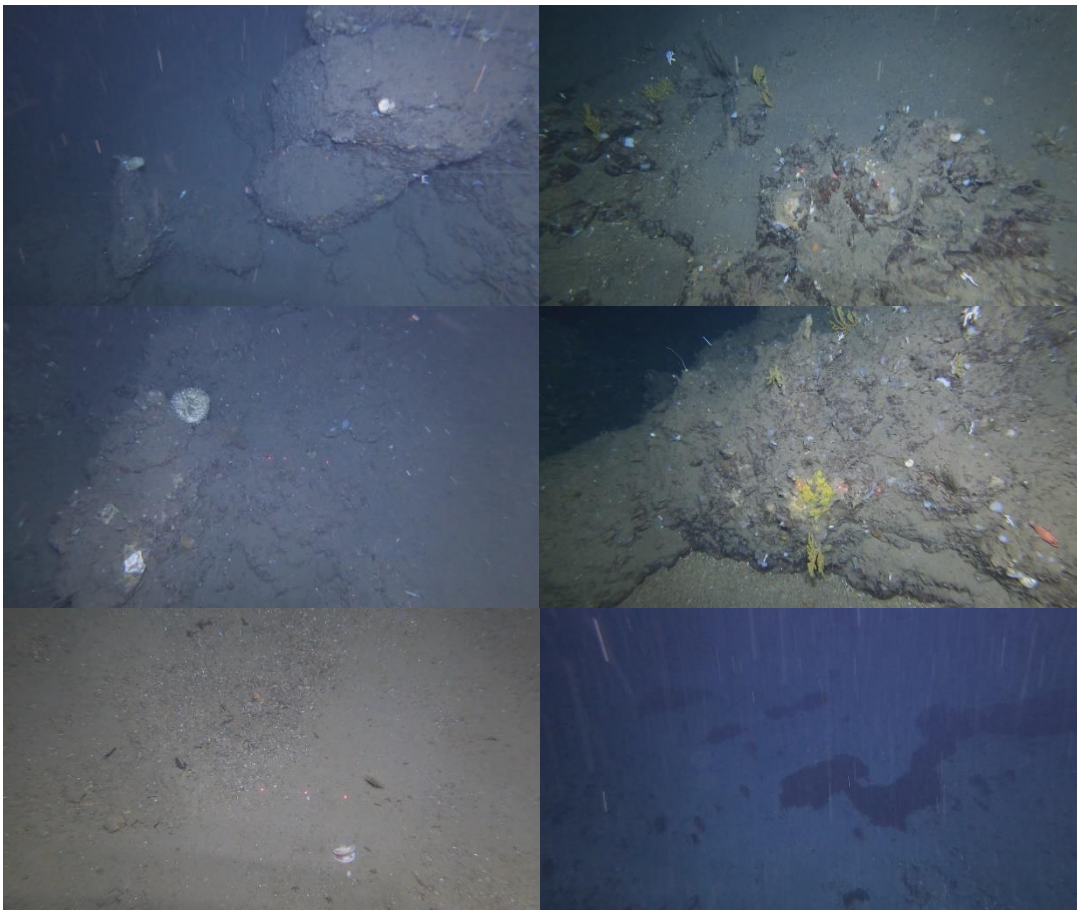


Figure 112. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel S, 25th August 2023.

26, 27, and 28 August 2023

The weather forecast for the days 26, 27 and 28 of August was bad, with big swell and winds gusts that could reach 24 knots. It was far worse than what we experienced on the previous day, which caused us to end our working day prematurely and several failures in the scientific equipment. There were no conditions to operate the Azor drift-cam system safely, therefore we decided not to leave the harbour of Ponta Delgada. The scientific team used this time to work on more clerical tasks, such as editing and completing the mission report, taking quick notes of some of the fauna observed at the visited stations, and planning the next days at sea. Additionally, it was possible to use everybody's help to move to our new base near the town of Lagoa on the 26th of August in a beautiful and spacious house in the south of the island of São Miguel, and to buy some groceries for the next days. During these days, the team members decided to take a short nature trail in order to maintain their physical and mental health. On August 28, the scientific crew said goodbye to its members João Balsa and António Godinho, and welcomed Isabel Areosa and Alexandra Rosa to help with the work over the coming weeks.

29 August 2023

Finally, after many days of bad sea, the forecast for the day showed some improvement. Nevertheless, on the morning of the 29th of August the swell arriving from the East remained strong and our initial plan to navigate toward São Miguel SE had to be changed. We decided to remain in the vicinity of the harbour of Ponta Delgada (São Miguel SW), where we performed 5 dives between 403 and 805 m depth, with our first station beginning at 10h17 (St166). All drifts were good, although navigation remained troublesome because of the swell and of strong bottom currents that tended to lift our drift-cam from the seafloor. All dive sites appeared to be characterized by strong sedimentation, with the seafloor showing extensive areas of sandy/clay bottoms and patches of coral rubble. Rocky outcrops were found at all stations, even though also these were covered by a layer of soft sediment.

In general, the explored areas did not show a large density of coral and sponge species, that were mostly represented by colonies of small sizes. Among these, the most common were *Acanthogorgia* spp. and *Parantipathes hirondelle* for corals and *Characella pachastrelloides* complex, *Macandrewia azorica*, *Farrea* occa, and some occasional *Pheronema carpenteri* (St168) for sponges. The fauna was characterized by fishes from Macrouridae family and the bluemouth rockfish, *Helicolenus dactylopterus*, and the echinoderm *Cidaris cidaris*. Differently from the remaining stations, St170 was characterized by large, dense, and diverse filter-feeders. This was our shallowest dive of the day. Large, and some smaller, colonies of *Callogorgia verticillata* formed extensive coral gardens that also included *Viminella flagellum*, *Acanthogorgia* spp., small colonies of *Dentomuricea* aff. *meteor* and other coral species, such as the *Paramuricea/Placogorgia* complex. At one of the stations, alongside corals, we could identify many sponges including: *Leiodermatium* (white and blue morphotype), a lot of specimens of *Hoplostenus mediterraneus* and a few *Aulopus filamentosus*. During this day we were surprised by one shark in St168, *Deania* sp. and one ray, cf. *Dipturus* sp. The invasive algae *Rugulopteryx okamurae* was visible at all sites. Lost fishing lines were spotted during most dives. After many days of rough weather, a smooth day of work was very welcomed and really lifted our spirits. The discovery of an astonishingly beautiful coral garden right off Ponta Delgada seemed like an appropriate way to conclude our day, so we navigated back to the harbour where we arrived at 19h40. The only gear problem we had during the day was the cap with 2 sets of 4 pins that cover the cylinder of the battery, that had to be replaced before the last dive.

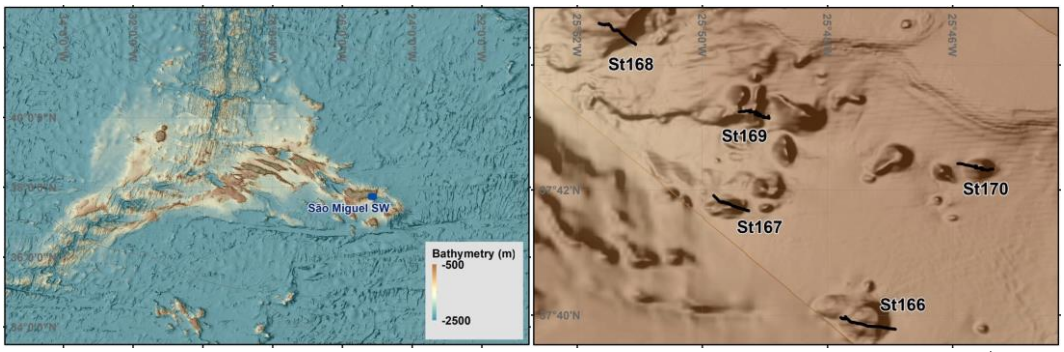


Figure 113. Location of São Miguel SW and the dives conducted with the Azor drift-cam in this area, 29th August 2023.

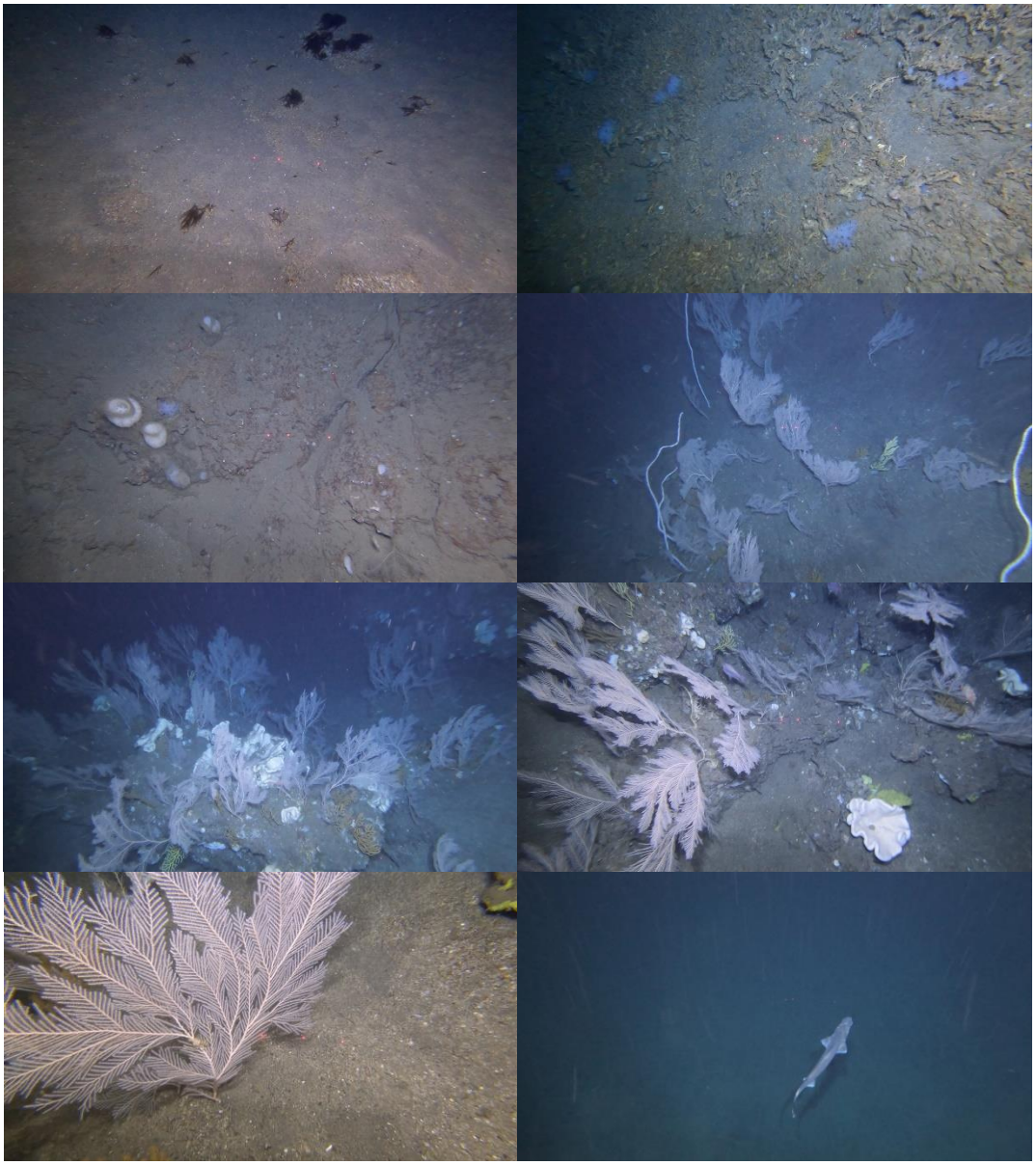


Figure 114. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel SW, 29th August 2023.

30 August 2023

Finally, a very welcomed day of good weather arrived and several more were expected to come. We took this opportunity to sail toward the eastern tip of São Miguel (SE). We left the harbour of Ponta Delgada around 8h30 and after a trip of more than one hour we arrived at the first dive site. We attempted 5 dives between 218 and 846 m depth. In general, the drifts of the day were good, sometimes requiring small adjustments by the skipper. In the first two transects (St171-172) the drift cam hovered over the seafloor for more than 1 km. The third transect (St173) happened during the high tide slack and was more problematic. It showed a very slow drift of circular shape, indicating that our camera did not move much from the starting position. The fourth dive (St174) was going according to the plan but after about 25 minutes of bottom time we lost the live view and the dive had to be aborted. After recovering the drift cam system, we realized that during the ascent we lost the weight and that the live view had been interrupted due to water entering in the GitUp housing. The camera was broken and so the SD card, making it impossible to recover the GitUp videos. Luckily, we still had the GoPro videos.

After replacing the GitUp housing and setting up a new camera, in St175 we resumed the dive from where the previous one ended. All dives showed sandy bottoms with some patches of coral rubble and sporadic rocky boulders. In stations 172 and 174 we encountered very steep walls that made the navigation challenging.

Throughout the dives, we drifted over some coral gardens, mainly formed by *Viminella flagellum*, alongside with *Acanthogorgia* spp. and *Dentomuricea* aff. *meteor*, as well as several sponges of the genus *Geodia* spp., and the species *Macandrewia azorica* and *Oceanapia coriacea.* The fishes were represented by shoals of *Capros aper*, specimens from Macrouridae family, *Lepidorhombus whiffiagonis, Helicolenus dactylopterus* and *a Polyprion americanus.* We also had the chance to spot the foraminifera *Syringammina fragilissima* on the sandy bottom. After the last dive, we had to return to the harbour of Ponta Delgada to fix some bureaucratic issues with the local marina. The trip took a little over 1 hour, and we arrived at the harbour around 19h30. Before leaving the boat, we had a small meeting and decided to take advantage of the good weather forecast moving our operation to the Eastern side of São Miguel, one of the most difficult places to work. In fact, this area is very far from most harbours and very exposed to bad climatological conditions. Refuelling operations were required on the following day, but they were not possible before 9h30 neither in Ponta Delgada nor in Vila Franca do Campo. We decided to meet with the MT Physeter and its crew in Vila Franca do Campo by 9h30 of the next day to refuel and then to continue moving the boat toward the eastern tip of São Miguel.

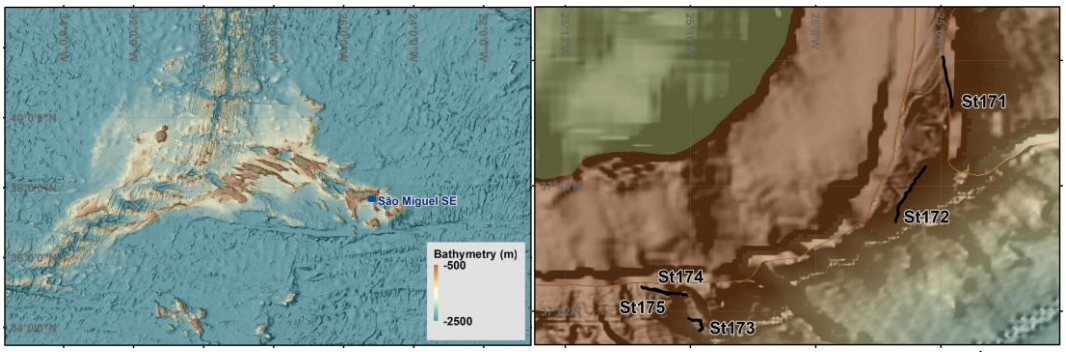


Figure 115. Location of São Miguel SE and the dives conducted with the Azor drift-cam in this area, 30th August 2023.

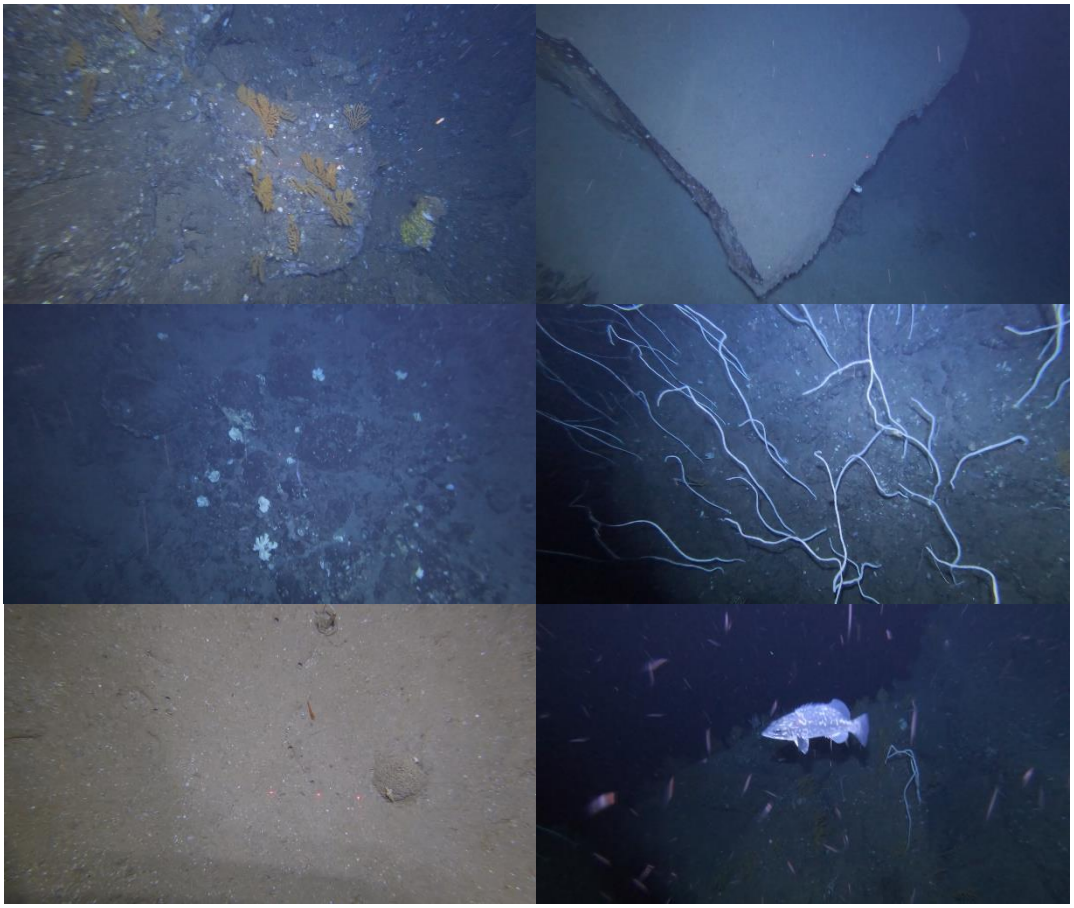


Figure 116. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel SE, 30th August 2023.

31 August 2023

The MT Physeter stayed during the night in Ponta Delgada, but as planned on the previous day, we met with the boat and its crew in Vila Franca do Campo for the refuelling operations that were scheduled at 9h30 – time at which the service station opened. After refuelling, we navigated 40 minutes and did a quick stop-over in the harbour of Povoação to check with the local authorities if it was possible for the boat to stay overnight and, in this way, to remain closer to the eastern side of the island. We left the harbour of Povoação at around 11h00 and headed towards our first station in São Miguel E. In total, we performed 4 transects between 298 and 874 m depth. The first three dives showed good drift (St176-178). The fourth and last dive (St179) had to be aborted because the electrical cable transmitting the live view signal broke in the winch. We headed back to the harbour of Povoação by 18h20, arriving around 19h10. There we spent about 30 minutes fixing the electric cable. The operation was successful, but we still had to shorten the nautical rope so that during the deployment of the camera system the tension could be absorbed by the nautical and not by the electric cable. None of the people on board felt confident with this task, so we decided to ask for help to some fishermen (normally accustomed with this task) on the following days. Soft bottoms dominated most of the transects. Even on steep slopes, where rocky outcrops showed up, thick layers of sediments remained visible. It was in St176 that the most abundant and diverse benthic megafauna with coral and sponge aggregations were showed, dominated by the coral species *Viminella flagellum* and *Acanthogorgia* spp. and the sponge species cf. *Poecillastra compressa*. During the day we saw other sponge species including cf. *Macandrewia azorica*, big specimens of *Characella Pachastrelloides* complex and cf. *Phakellia ventilabrum* and sporadic colonies of the coral *Callogorgia*

verticillata. Small sponges appeared to be very common at St177. The mobile fauna included, among others, the crab *Cancer bellianus*, the fishes *Heliconeluns dactylopterus*, juveniles of *Lepidorhombus whiffiagonis* and specimens from Macrouridae family. The foraminifera *Syringammina fragilissima* was visible in one of the dives. This station was also characterized by the sighting of many specimens of the shark species *Deania* sp. Before heading back to our base in Lagoa, one-hour away from Povoação, we decided to have dinner with the crew of the Physeter at the restaurant "Riquim".

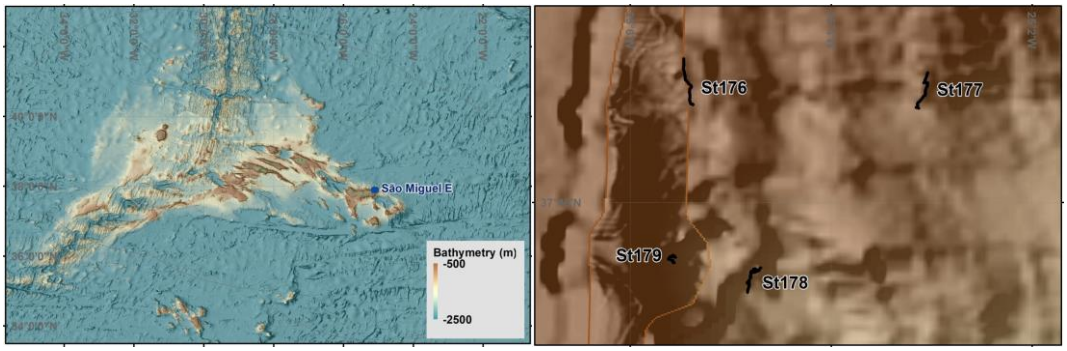


Figure 117. Location of São Miguel E and the dives conducted with the Azor drift-cam in this area, 31st August 2023.

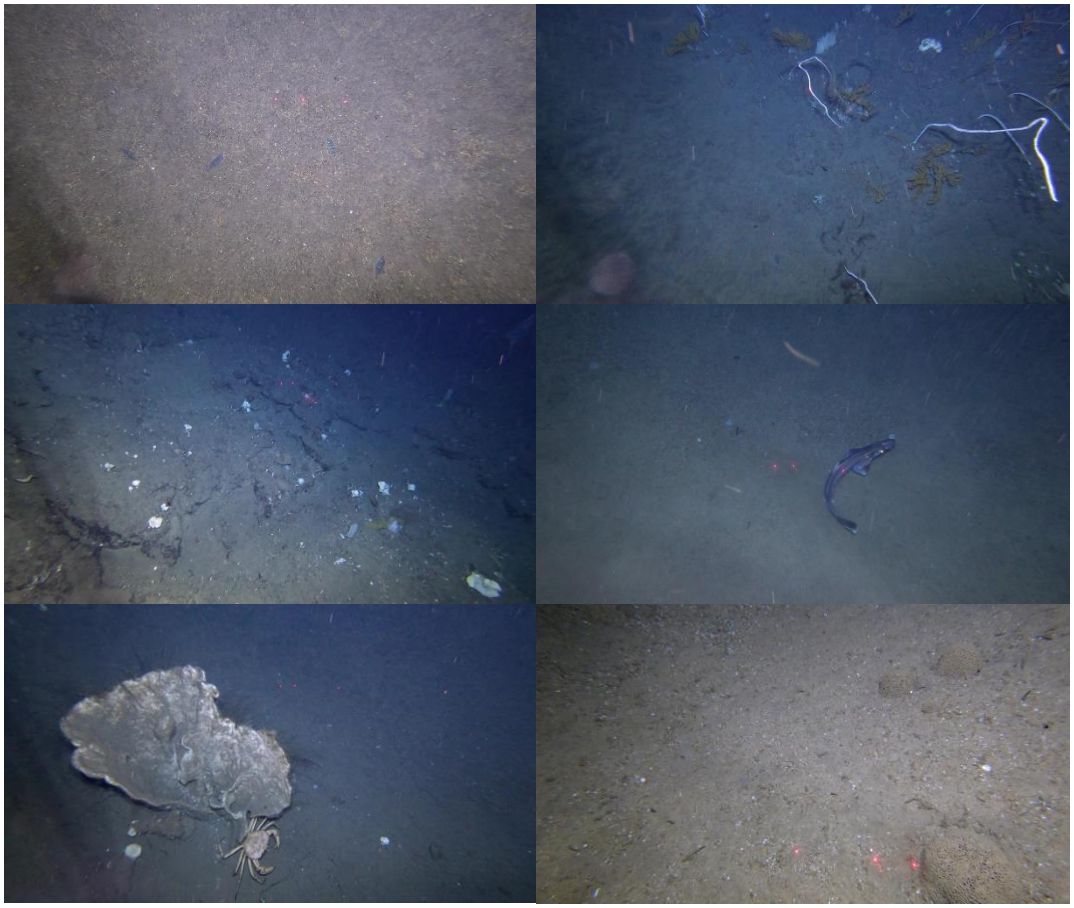


Figure 118. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel E, 31st August 2023.

01 September 2023

After one-hour drive from our base in Lagoa to the harbour of Povoação, we arrived at the MT Physeter by 8h30. There we spend some time finishing to set up the third set of nautical and electrical cables with the buoys (note that one set broke on the 25th of August, and one on the 31st of August), and around 9:30 we sat sail towards São Miguel E. During the journey to the first station, we tested the live view and discovered that another converter AV2HDMI stopped working. We had to replace it to solve the problem. The weather was good, but bottom currents were very strong causing a fast drift of our camera system. All dives covered a long distance (≈1000 m) and a wide bathymetric range, with a very fast navigation. In total, we completed 4 long dives between 306 and 928 m depth, starting the first dive at 10h26 and ending the last dive at 18h47.

All dive sites were characterized by large areas of soft sediment and by low density and diversity of benthic megafauna. Small patches of rocky substrates were visible here and there and they become a dominant feature for large parts of St182. Towards the end of St180, on rocky outcrops, some colonies of the coral species *Viminella flagellum* and large colonies of the coral species *Callogorgia verticillata* were observed. Several incrusting sponges were found on the basaltic walls encountered, together with specimens of the genus *Geodia* spp., *Petrosia* spp. and the species *Farrea occa*. At two stations, large areas of sand were covered with Foraminifera, potentially of the family Monothalamea (cf. *Syringammina fragilissima*), with many small shrimps and fishes around. During all dives, we encountered quite a variety of fish species such as the bluemouth rockfish *(Helicolenus dactylopterus*), Kaup's arrowtooth eel (*Synaphobranchus kaupi*), several Alfonsino (Beryx splendens), several specimens of the family Macrouridae, two specimens of monkfish (*Lophius piscatorius*), and one of *Cyttopsis rosea*. *Capros aper* were particularly abundant in dive St180, solitary and in small schools. We also had the rare sighting of *Gaidropsarus* sp. that could potentially be a new species in the region! We also had several sightings of the shrimp *Aristaeopsis edwardsiana.* In all dives, many lost fishing lines were seen, and litter was also commonly seen in the last dive. At St183, the available bathymetry (low resolution) was giving a value of 520 m depth, but when deploying the drift-cam, 900 m of cable went into the water. After recovery of the data logger, we confirmed that the actual depth of the starting point of the dive was 750 m depth. After the end of the last dive, we set sail toward Vila Franca do Campo for refuelling on the next morning. We arrived at the harbour around 19h30.

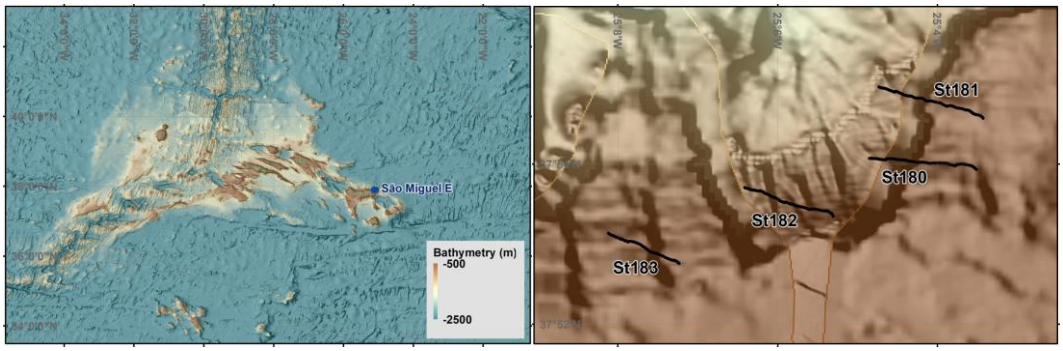


Figure 119. Location of São Miguel E and the dives conducted with the Azor drift-cam in this area, 1st September 2023.

Figure 120. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel E, 1st September 2023.

02 September 2023

As planned on the previous day, we met with the MT Physeter and its crew in Vila Franca do Campo for the refuelling operations that were scheduled at 9h30. We arrived a little earlier than that to see if we could find someone able to help us fixing the second set of nautical and electrical cable that broke on the 31st of August. We needed to cut, shorten, and splice the nautical cable. Our skipper Pedro went to ask for help to local fishermen that were one pontoon away from us. Mr. António Santos was very kind and offered to fix the cable for us; the whole operation took less than 10 minutes. Unfortunately, the refuelling operations did not go as smoothly as the fixing of the cable. For the service station to open, it was required the presence of officers from the Portuguese "GNR". Even though we had scheduled the refuelling operations at 9h30, they only managed to arrive at 11h30 and we could only leave the harbour of Vila Franca do Campo at 11h50. A bit frustrated with the delay, we set sail toward our fist station (St184), where we arrived at 12h58, after one hour of navigation. In total we completed 5 dives in São Miguel SE between 566 and 819 m depth.

The bottom was characterized by the presence of soft sediments, even on rocky outcrops and boulders, and some scattered coral rubble patches except for St185 where the bottom was mainly coral rubble. Common to most dives were the black coral *Parantipathes hirondelle* and the gorgonian *Acanthogorgia* spp., while cf. *Stylasteridae* sp1. dominated St185 and cf. *Pseudoanthomastus* spp. the St187. The Porifera group was very common with several specimens of cf. *Regadrella* spp., with *Farrea occa* and cf. *Macandrewia azorica*, with the sporadic presence of *Characella Pachastrelloides* complex. Motile fauna was not very common in any of the visited sites. The most frequent fishes were from Macrouridae family and the species *Helicolenus dactylopterus.*

We also observed a many sea urchins *Cidaris cidaris* and cf. Crinoidea purple sp1. During the last dive of the day (St188) we hit a vertical wall and the GoPro housing was tilted, completely facing down. Therefore, the GoPro video ended up being not very useful. Besides the GoPro housing, the general setting of our drift cam (e.g., lights angle, GitUp housing angle, etc.) got a bit messed up. After this, we went to the harbour of Povoação, where the boat stayed for the night. We had dinner with the crew of the Physeter to discuss about a worrisome weather forecast, with predicted wind gusts of over 50 kts and 5 m waves. It was decided to check the forecast on the next day and, if it remained the same, to move the boat to the marina of Ponta Delgada, which appeared to be more sheltered based on the direction of the incoming wind and wave.

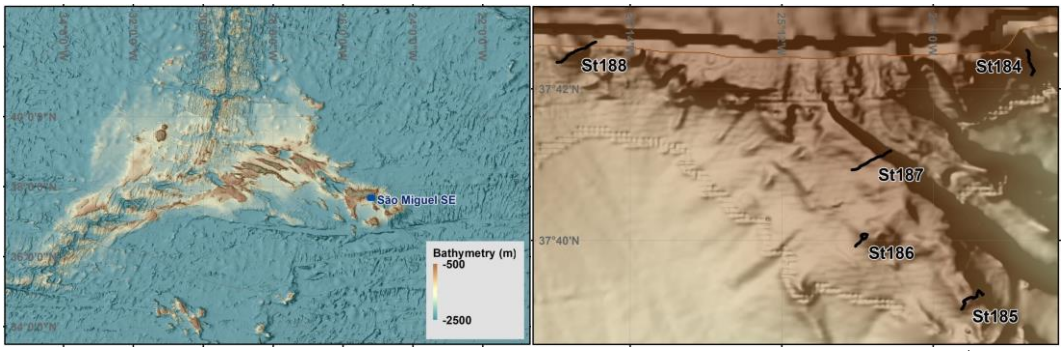


Figure 121.Location of São Miguel SE and the dives conducted with the Azor drift-cam in this area, 2nd September 2023.

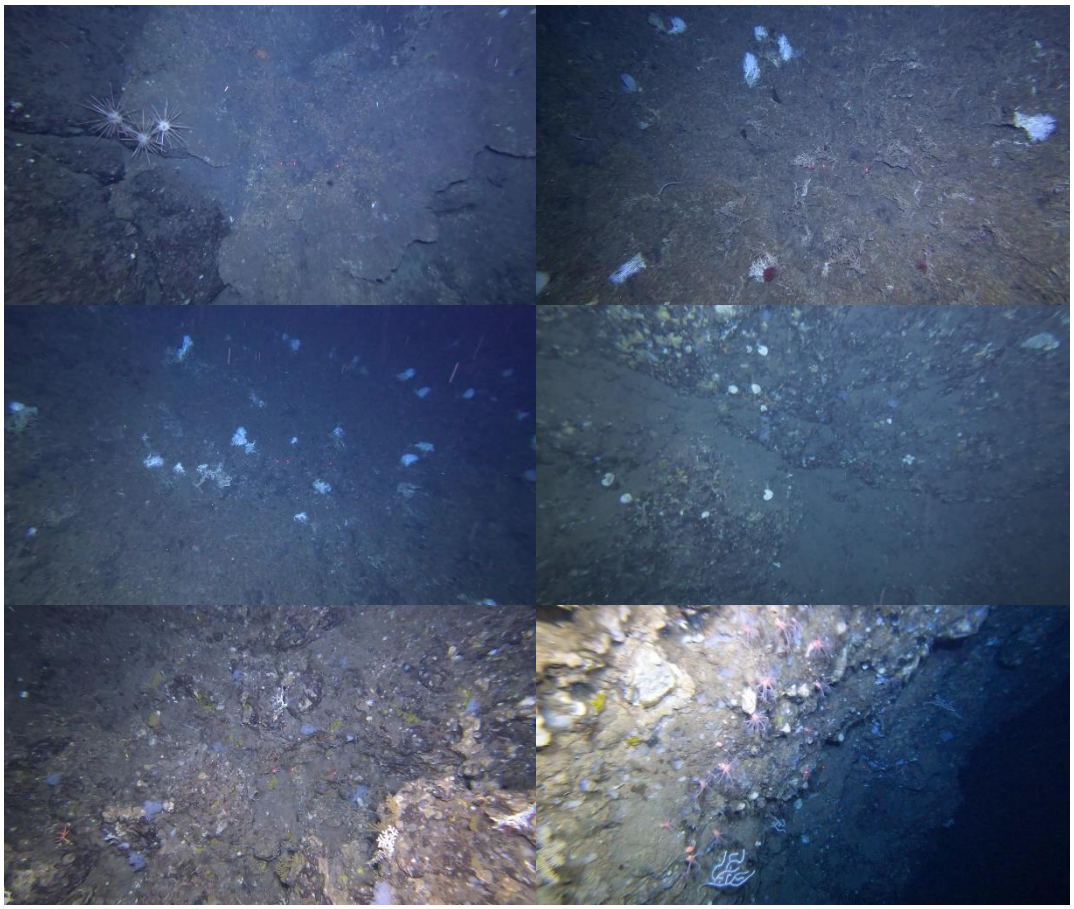


Figure 122. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel SE, 2 September 2023.

03 September 2023

We left our home in Lagoa a little earlier than 8h00 and arrived at the harbour of Povoação by 8h55. Before moving to our first station (St189) we spent some time restoring the configuration of our drift cam system (i.e., camera angle and light position) and securing some parts that got loose after hitting the wall in last dive of the previous day. We found out that also two of the ropes that held the buoys in place were damaged and had to be changed. We left the harbour at 09h20 and after a transit of 14 nm we arrived at our first station during slack tide (10h23). Winds and currents were weak, so we were unsure about the direction of our drift. We opted to wait a little before starting our first dive (10h37). We tested the live view and discovered that the board that receive and retransmit the AV signal from the GitUp (AV2HDMI) was not working and had to be replaced. We completed 4 dives between 382 and 944 m depth, three in São Miguel NE and one in São Miguel E. After the fourth dive we checked again the weather forecast with the crew of the MT Physeter. It still looked very bad, with predictions of 4 to 5 m wave height and wind gusts reaching 40-50 knots (Figure 125). In order to be sure to have a safe place where to moor the boat, we ended our operations a bit earlier than usual, at 16h36, and set our heading toward Ponta Delgada, where we arrived after two hours and a half. Probably because of the weak wind, all our camera transects covered a small distance. The drift of St190 did not go as expected and mostly passed over a very flat sandy bottom causing troubles in the navigation because of several factors including lack of contrast in the live view image; resuspension of sediment when the weight of the drift cam hit the bottom; very weak bottom current that did not push away the re-suspended sediment. The drifts at the remaining sites were good, albeit not perfect. All the explored areas were entirely covered by sand or clay and were characterized by a low abundance and diversity of benthic megafauna. Only during the first dive, the shallowest of the day, it was possible to see a few rocks on top of which the coral fauna was essentially represented by *Viminella flagellum* and *Acanthogorgia* spp., and the sponge fauna by *Characella Pachastrelloides* complex and *Leiodermatium* spp. On soft sediments Ceriantharia and Foraminifera could be seen. Among fish species we could identify specimens from Macrouridae family, individuals of the species *Capros aper* and probably the second sighting of *Gaidropsarus* sp. At St189 we observed a crab (*Cancer bellianus*) close to a big sponge (*Characella pachastrlloides* complex).

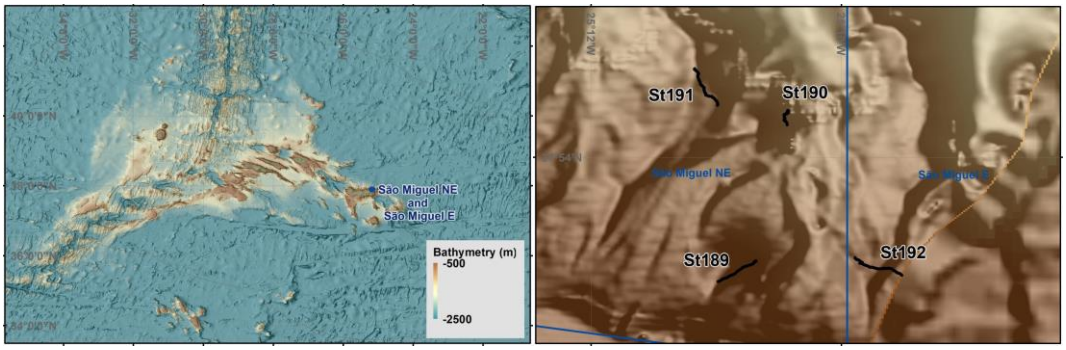


Figure 123. Location of São Miguel NE and E and the dives conducted with the Azor drift-cam in these areas, 3rd September 2023.

Figure 124. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel NE and E, 3rd September 2023.

Figure 125. Wind (on the left) and wave (on the right) forecast for the days 4 to 7 of September 2023.

4, 5, and 6 September 2023

On the morning of the 4th of September, the weather forecast was confirmed to be bad (Figure 125). There were no conditions to safely operate the Azor drift-cam or to go out at sea with the MT Physeter. We decided to cancel all maritime operations between the 4th and the 6th of September and to evaluate again the situation on the evening of the 6th of September. We used these days to complete all preliminary video analyses, update the mission report, organize all the collected data and their backups, and do a deep maintenance of the Azor drift-cam (e.g., substitute the O-rings, grease all metallic parts to prevent oxidation, clean and substitute damaged screws, check, and fix all electrical wiring, etc.). During these same days, the RV Arquipélago, its crew and scientific party also stopped in Ponta Delgada harbour. We took this opportunity to have dinner all together at the restaurant "Adega do Mestre André" and, in this way, to share our experiences about the ongoing sea-campaign while relaxing a bit after many days of field work. The chief scientists of the two vessels met before dinner to discuss about the work that remained to be done and plan the next steps once the weather improved. On the eve of every day, we consulted the weather forecast to check if any improvement was in sight. Unfortunately, that was not the case.

7 September 2023

On the morning of the 7th of August 2023, the weather forecast was still not promising, with predictions of wind gusts of 25 knots and waves of 1.5 meters. Nevertheless, after three days on land we felt like giving it a try, hence, we left the harbour of Ponta Delgada a bit later than 9h00. We headed 10 nm southeast, in the sampling area São Miguel S. The swell was big, and it was challenging to deploy our drift-cam in the water (10h24). The people operating the winch had to be very careful not to get harmed and to ensure a safe and smooth operation. Besides all challenges, the dive (St193) followed the expected direction. The transect presented areas of soft and hard sediment, sometimes interspersed with patches of coral rubble. The rocky bottoms showed large coral colonies, *Callogorgia verticillata* at shallower depths and cf. *Pleurocorallium johnsoni* at greater depths. We drifted above sponge species such as *Farrea occa*, *Characella pachastrelloides* complex, and *Macandrewia azorica*, this last in less number. The fish most commonly seen was the usual bluemouth rockfish "*Helicolenus dactylopterus*". Unfortunately, once again, conditions were not good and safe for continuing to operate our drift cam. We headed back and, because of the rough sea, it took us 1h40 to complete the 10 nm to the harbour of Ponta Delgada, where we arrived at 14h25. Once there we decided to refuel the boat, so that we could save some time for the next working day.

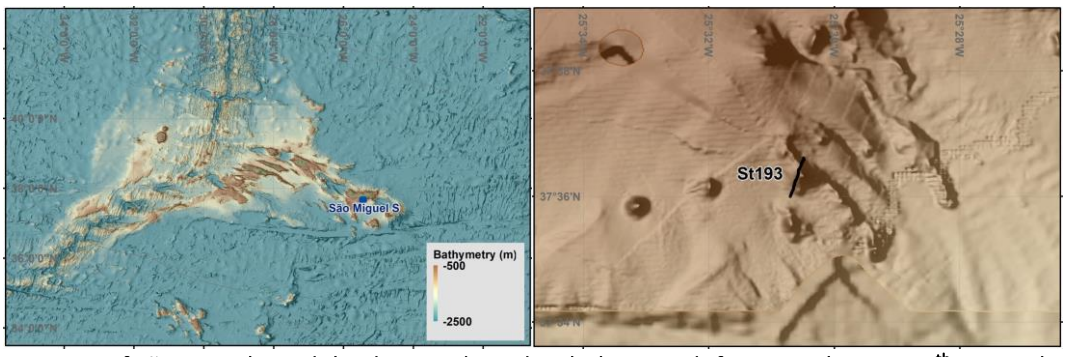


Figure 126. Location of São Miguel S and the dive conducted with the Azor drift-cam in this area, 7th September 2023.

Figure 127. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel S, 7th September 2023.

8 September 2023

On the 8th of September the scientific party changed. We once again welcomed our colleagues João Balsa, António Godinho and the newcomer Alexandre Morais, while we said goodbye to our members Gerald Taranto and Laurence Fauconnet, who returned to Horta. There was also a turnover in the MT Physeter's crew, with a new skipper coming in (Sisnando) and the old skipper, Pedro, leaving. Because of the bad weather conditions and because of this change in the scientific team, we spent this day on land dealing with logistical issues. The impossibility of going out at sea was also confirmed by the skipper of MT Physeter. During the day we had the opportunity to get the new members settled in, to go for groceries for the next few days and to meet with the boat's skipper, Sisnando, to decide on the work plan for the next few days and which areas to prioritize to launch our camera system. Although the forecast wasn't the best, it was agreed that we would try to get out at sea the next day and work on some underwater banks and ridges located South of the Island in order to be as shelter as possible from the incoming northern wind.

9 September 2023

The day started very bright and sunny. We left the Ponta Delgada harbour a bit later than scheduled, at around 09h05, because of a problem starting the engines of the MT Physeter. The problem was promptly solved by the boat crew, and we headed in direction of a small bank south of São Miguel Island. In our way to our first dive site, we took the opportunity to explain to the newcomer, Alexandre Morais, all the procedures required to operate the Azor drift-cam so that his adaptation and initiation to the work could be smoother. The forecast

said that the winds were supposed to be moderate, instead they were rather weak South of the Island, perhaps due to its protective effect, since the winds were coming from the North. We performed a total of 4 dives from 470 to 878 m. During our first two dives, the absence of wind and the flat sea, made our chances of moving very low. The drift was very confusing and unstable, not taking us where we wanted to, and even with the help of the skipper, it was very hard to approach the desired path. Because of the difficulty in navigating and having a good drift in this area, we decided to move a bit further West, to the sampling area identified as Mar da Prata N, an area that still had a lot of unexplored areas. Unfortunately, when our camera system was coming up, after the second dive, the electrical cable broke, so we had to weld it during the trip to the next station. Sea conditions in Mar da Prata N turned out to be rougher, with substantially more wind and wave activity. The drifts went as expected with the Azor drift-cam moving up the explored banks. Also the navigation was good, although punctual help from the skipper was required. When preparing the drift-cam for the third deployment, the cap with 2 sets of 4 pins that cover the cylinder of led and laser battery was not working. It had to be replaced, and stored for further repair.

Dives performed in Mar da Prata N were characterized by the presence of many lost fishing lines. The majority of the transects we did were composed of sandy bottoms, with the only exception being some parts of the dives in Mar da Prata, which showed a sporadic presence of basaltic boulders and outcrops. The first two dives showed a very poor presence of sessile fauna, with only a few sightings of fishes from the Macrouridae family and a *Molva macrophthalma*. A group of krill persistently followed our structure during a big part of the first dive (St194). The rare rocky bottoms of explored sites presented some coral presence, with relatively big aggregations of *Narella versluysi* and *N. bellissima*. Some specimens of *Calllogorgia verticillata* and *Hemicorallium tricolor*, were also spotted. Sponges were observed, with the Azor drift-cam filming big *Pheronema carpenteri* fields. In our third dive, it was possible to observe a considerable number of the echinoderms *Zoroaster fulgens*, at some basaltic outcrop slopes. Several *Helicolenus dactylopterus* appeared during the last two dives. After a long day, we decided to head home, arriving the Ponta Delgada harbour at approximately 20h00. A new member of the scientific team, Nicolas Collazo, was waiting for us at the port with Isabel Areosa. Nicolas is a student taking a period of studies in Horta and came to help us during this mission in São Miguel Island.

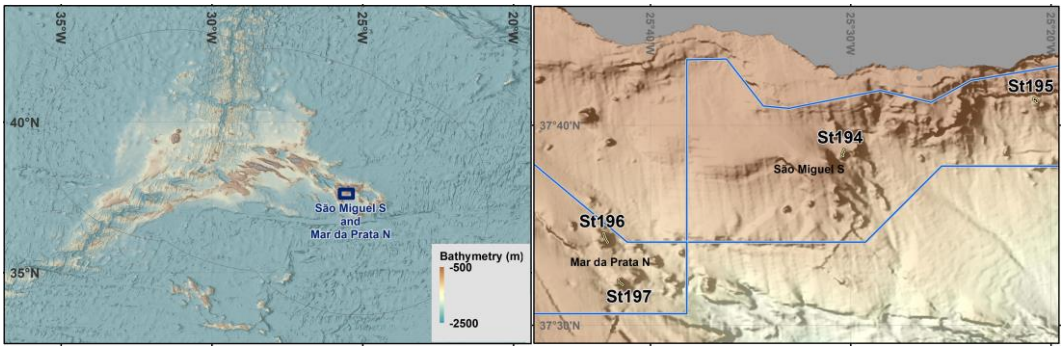


Figure 128. Location of São Miguel S and Mar da Prata N and the dives conducted with the Azor drift-cam in these areas, 9th September 2023.

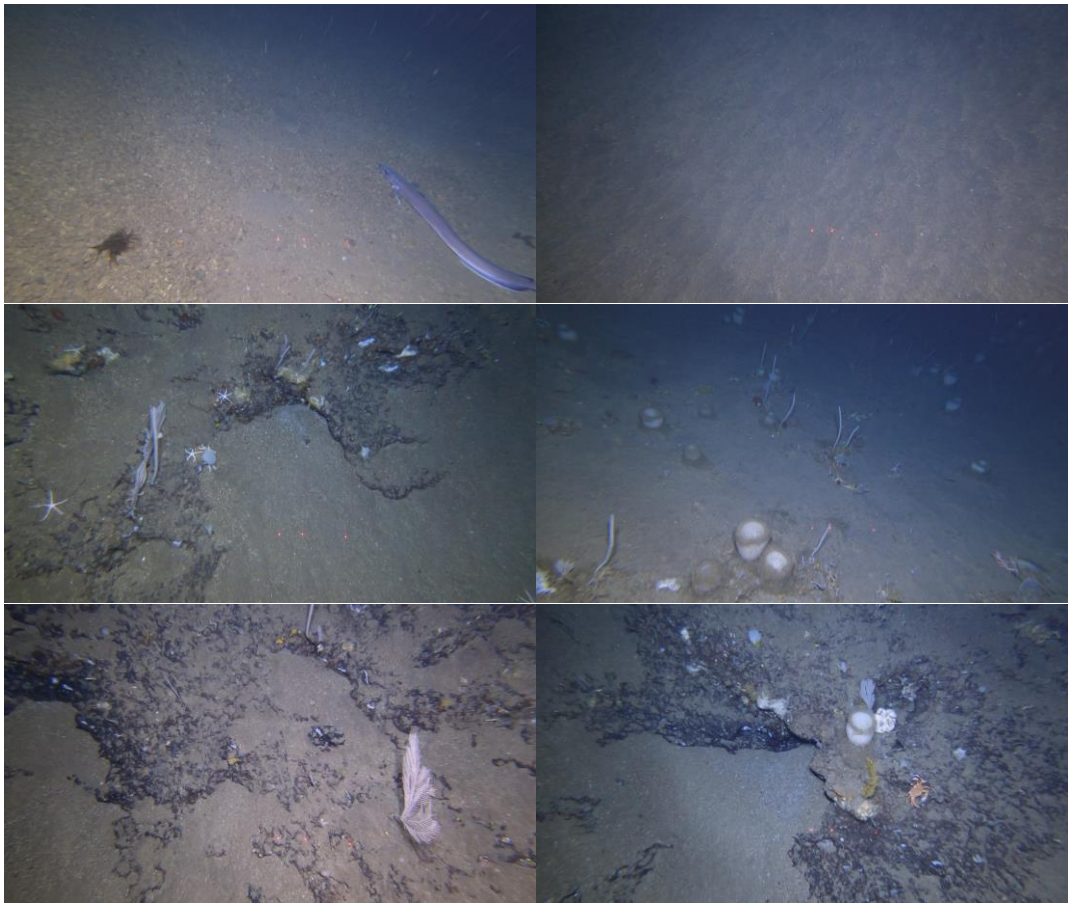


Figure 129. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel S and Mar da Prata N, 9th September 2023.

10 September 2023

We left Ponta Delgada harbour at around 9h26 in the morning in direction to one of the least explored area up to then: São Miguel West. The new student that came to help us, Nicolas, was taught about the procedures of the Azor drift-cam deployment and a bit of the work developed by our team. The forecast indicated that we would have wind blowing from the North, and when we arrived at the first station, that was confirmed. Moving West of São Miguel, the sea started to become a bit rough, but not enough to impede our work. We performed 4 dives from 420 to 820 m depth. For the first dive of the day (St198), we tried to pass over a seamount located in the western portion of the sampling area. The drift ended up being the opposite of what we expected, since the wind was from the North, but we moved against it. At first the drift was good and stable, but then it started to be more random, as we approached the seamount's slope. The skipper tried to help us with the drift, but with no success, and we ended up being taken to the East. The substrate observed consisted mainly of sandy bottom, with some boulder and not much fauna. We arrived at the location of the second dive of the day (St199) and apparently the drift pushed us S/SW. Therefore, we decided to start North of the targeted bank. We landed on a rocky bottom, with basaltic outcrops, the drift was perfect, and we crossed the bank as desired. Before the third deployment of the day, we celebrated the 200th dive with the vessel MT Physeter. The sea surface at this new station was in good condition, the wind was a little odd, and drift was good and stable heading SW. We landed on a rocky bottom and found a lot of lost fishing lines and rocky outcrops throughout the dive. Unfortunately, the dive had to be shortened due to the quantity of lost fishing lines suspended and because of the fear of being trapped in one of those. The last dive of the day, St201, also had a nice stable drift to SW, with

the wind strength slightly decreasing during the dive. At this last station, the structure got stuck in a fishing line. Thankfully, it got loose as it was being lifted to the surface, but unfortunately the rudder broke in the process.

The fauna found during this day was truly diverse, mainly in the last three dives. The basaltic outcrops that characterized the bottom in the majority of the stations, were colonized by some of the usual coral species such as *Acanthogorgia* spp., *Viminella flagellum*, *Paramuricea/Placogorgia* spp., and some specimens of the family Stylasteridae. A high number of *Pseudoanthomastus* spp. were noticed at the two last dives, as well as two species of black corals, *Antipathella subpinnata* and *Parathiphates hirodendelle*. Sponges were represented by the presence of *Characella pachastrelloides* complex, *Farrea occa*, *Phakellia ventilabrum* and specimens of the genus *Petrosia* spp and *Geodia* spp. The fishes spotted during the dives of the day belonged to the species *Beryx decadactylus, Hoplostethus mediterraneus* and an exemplar of the sixgill shark, *Hexanchus griseus* that nudged against our camera system. Finally, it's important to notice the observation of a *Paramola cuvieri* carrying a sponge on her the back. After the 4th dive, we returned to Ponta Delgada and proceeded with the substitution of the broken rudder and minor structure maintenance.

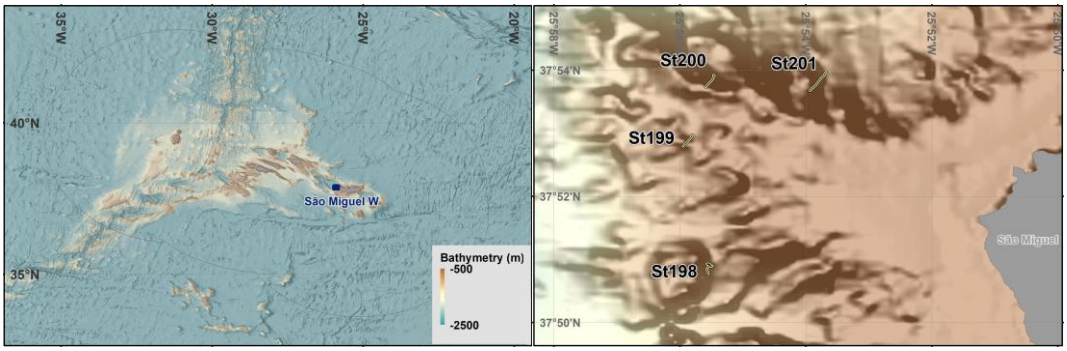


Figure 130. Location of São Miguel W and the dives conducted with the Azor drift-cam in this area, 10 September 2023.

Figure 131. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel W, 10th September 2023.

Figure 132. Evidence of the anthropogenic pressure on benthic fauna (lost fishing lines stuck in a sponge).

11 September 2023

Today, the MT Physeter had to be refuelled again. Because of this, we had to delay our departure from Ponta Delgada harbour to 10h00 in the morning. Once we left the harbour, we headed to São Miguel NW, one of the sampling units where only a few video transects were available. The forecast for the day indicated light wind blowing from NE, so we expected some nice drifts going from deep to shallow areas. We performed a total of

4 dives from 414 to 709 m. We arrived at the first station at around 11h00. Right after the first deployment (St202) we had to bring the structure back on board, because the GitUp camera was not well positioned in its housing and the live view video was partially obscured by the housing itself. The drift was erratic throughout the dive. At first, instead of going North as expected, the drift was going East. After a few minutes, the drift shifted to the North, then returned to the East, but a short time after went South, and then East again. This dive happened close to the slack tide, which might explain the drift randomness. Eventually, we decided to end the dive because the structure stopped, and the skipper could not do anything to improve the situation. The bottom was sandy during the entire dive. For the second dive of the day (St203), we decided to head to a crest slightly Southward from the previous dive. This dive happened during the slack tide, and even though the skipper couldn't help at all, since the boat GPS system broke, the drift was good and steady to SW, but the navigation proceeded slightly sideways. During the dive the wind dropped completely. The bottom observed was sandy with a few basaltic boulders. The third dive of the day (St204) occurred with almost no wind and calm sea. The drift seemed to start well, with a SW drift, but a few moments after reaching the bottom, it started looping. We asked the skipper to help us move SW, but the navigation and the drift remained very confusing. Unfortunately, we passed right next to the seamount. The bottom was sandy with occasional sparse boulders. For the fourth and last dive of the day (St205) we tried to visit two small seamounts located right next to each other, and, therefore, in between seamounts, the slope remained behind the camera. The drift was good and went as expected following a SW direction. The bottom was rocky with plenty of associated fauna. No technical problems with the Azor drift-cam and its components occurred during the day. The fauna was abundant, mainly in the last three dives, with the presence of the commonly found corals *Viminella flagellum*, *Callogorgia vericillata* and *Acanthogorgia* spp. mostly on rocky bottom and of *Flabellum* spp. on sandy grounds. During the last dive, on a basaltic outcrop, some specimens of what is believed to be a purple coral species of the genus *Paramuricea* were observed. It is not very usual to find this coral species around the Azorean archipelago. Our structure drifted above some common sponge species such as *Farrea occa, Macandrewia azorica, Desmacella grimaldi* and several individuals of the genera *Petrosia* and *Geodia*. Throughout all dives, many fish and shark species could be observed, from which we can highlight the *Conger conger, Molva macrophthalma* and an exemplar of the ray *Dipturus intermedius*. We returned to Ponta Delgada at around 18h20.

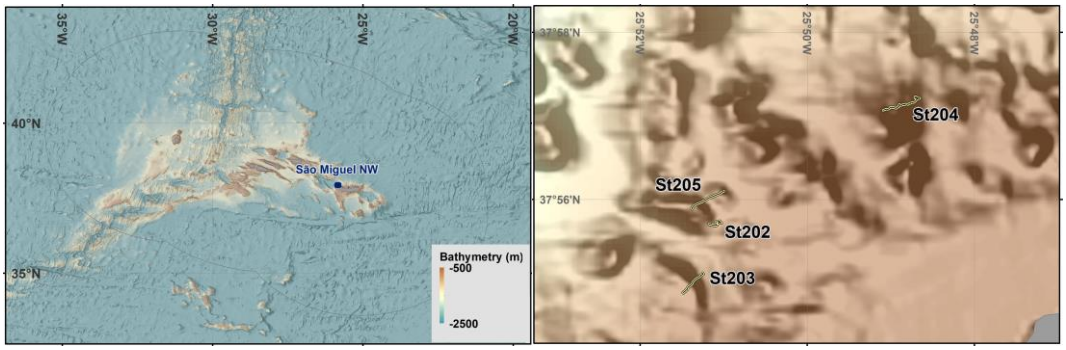


Figure 133. Location of São Miguel NW and the dives conducted with the Azor drift-cam in this area, 11th September 2023.

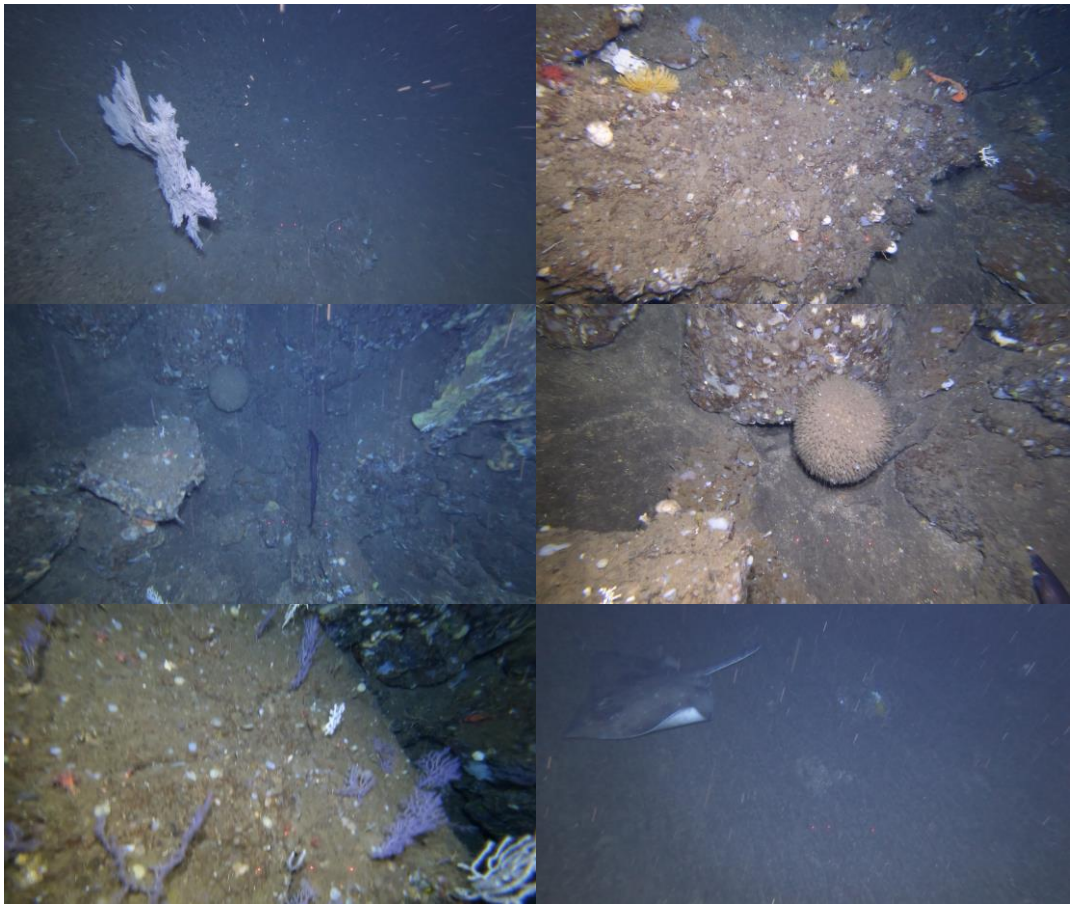


Figure 134. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel NW, 11th September 2023.

12 September 2023

In a very sunny morning, we left Ponta Delgada harbour at approximately 8h40, heading toward the North side of the Island, to visit some points of interest in São Miguel N. We performed 4 dives from 422 to 969 m depth. During the trip to the first sampling station, that took us around 1h30, we were fortunate to spot some sperm whales. Once arrived, the sea conditions corresponded to the forecast with a light eastern wind and almost no swell. At first glance it looked as if we weren't going to have a steady drift towards our point of interest, but the drift of the first dive was quite good, heading east and the navigation was relatively easy to do. When we were preparing to deploy the Azor drift cam, the live view feed showed some issues. The problem was the little converter "AV2HDMI", and we had to replace it. We headed to a bank a bit closer to land to do the second dive of the day. When we were preparing to deploy our system, we noticed a problem with the cap with 2 sets of 4 pins that cover the cylinder of the LED and laser battery, so we had to replace it. After the replacement we deployed our system in the water and landed on a sandy bottom. The drift went as expected, heading east and the navigation was very stable. Nevertheless, it was a little bit slower than expected so we had to ask the skipper to help us a bit to reach the top of the mount. After one hour and ten minutes on the bottom we found basaltic outcrops.

Our third dive (St208) was deep (around 900 m), the drift was very good, heading east again and the navigation was smooth and stable. We landed on a rocky wall, but some minutes after, the seafloor changed to sandy bottom with a few sparse basaltic outcrops. For the last dive of the dive, we tried to climb a seamount close to the shore. We were especially cautious with this dive because of the high probability of finding lost fishing lines. The sea conditions didn't change, and we still had almost no wind and a very calm sea. At the start, the drift

was very confusing, with the boat going to every direction, so, once again, we had to ask to the skipper for some help. The navigation was challenging due to the constant change of drift. This dive was characterized by sandy bottom. We recovered the system after 53 minutes of bottom time because of the terrible drift we were having. Despite many sandy bottoms without much fauna, during this day we recorded some corals species that were not very common during this leg such as the black coral *Leiopathes expansa*, on the deepest walls, the gorgonian coral *Muriceides paucituberculata*, the bamboo coral *Acanella arbusculla,* the scleractinian *Leptosammia formosa* and some more usual ones like for example *Viminella Flagellum* and *Acanthogorgia* spp. The basaltic outcrops were characterized by an abundant coral fauna, contrasting with the almost absence of fauna on the sand bottom. The sponge diversity was high, with some colonies reaching very prominent sizes. It was possible to observe species such as *Characella pachastrelloides, Macandrewia azorica, Leiodermatium* spp. (white morphotype) and the more common "bird's nest" sponge *Pheronema carpenteri*. Some specimens of *Regradella phoenix* were also found. Some motile fauna was observed such as the shark *Deania* sp., *Thrachyscorpia cristulata*, several Anguiliforms (mainly at St206) and fishes of the genus Macrouridae. We decided to come back to Ponta Delgada harbour at approximately 19h10, under a great sunset.

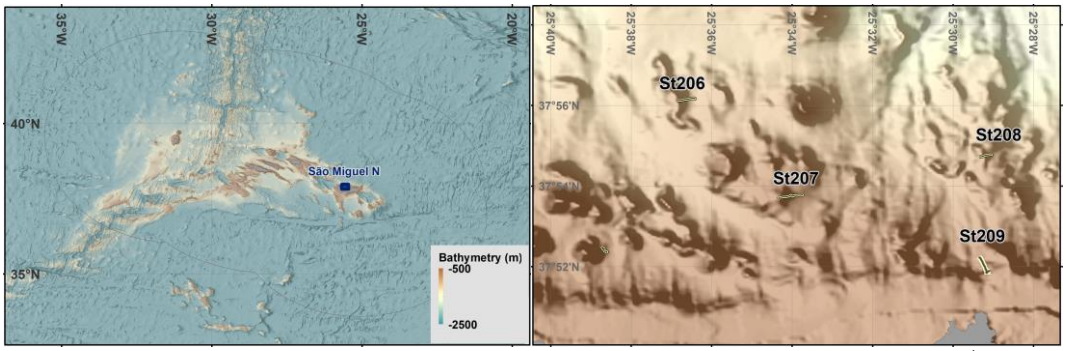


Figure 135. Location of São Miguel N and the dives conducted with the Azor drift-cam in this area, 12th September 2023.

Figure 136. Screenshots extracted from the video footage recorded with the Azor drift-cam in São Miguel N, 12th September 2023.

13 September 2023

Today was the last day of field work of the Leg 5 on board of the MT Physeter. The boat crew decided that it would be better to sail back to Faial Island on the following day, because of the approach of a depression to the archipelago. We left Ponta Delgada harbour at around 9h45, a bit later than the usual because the boat had to be refuelled. In addition, some minor problems also contributed to our late departure. The onboard PC routinely used by the scientific team for data handling and navigation was not turning on, but the problem was solved after a few attempts. We had to fix the bottom screws that supported the main axis of the Azor drift-cam structure. During the day we performed a total of 3 deep dives from 740 to 997 m depth. The day was a bit windier than the previous ones, but not too much, think that potentially could help us with our drifts.

For our first dive (St210), initially we had decided to go for a deep ridge north of Mar da Prata N, but once we evaluated the drift direction before the deployment, we discovered that it was heading NW and not N as expected, making it impossible to perform the planned dive. With this information, we decided to change the location and went for another one, two nautical miles toward the South. After the deployment, the drift remained constant taking us right to the summit of the crest, but, toward the end of the dive, the drift changed and started going straight North. The navigation was stable and without major complications. At the start of the transect, the bottom was sandy, but extensive basaltic outcrops started showing up after a while. The second dive started at the base of a deep crest. The drift was very strong and the navigation very challenging (almost impossible) since the structure was lifting from the bottom all the time because of the combined effect of the drag of the large amount of cable in the water and the drift velocity. The tension exerted on the electrical cable made it break. We decided to end the dive at that moment. The bottom was composed only of sand. After fixing

the electrical cable we went for a slightly shallower crest, where the drift stayed North and very strong. Even with the strong drift, the navigation was not very difficult. The fast drift made us cover a long transect. We landed on a rocky bottom, with sandy patches, and this mixture of sandy and rocky bottoms characterized most of the dive. The basaltic outcrops and boulders that we saw hosted a relatively high abundance of benthic fauna. Coral gardens of *Narella bellissima* and *N. versluysi* were seen at the first and last dives. Some other coral species were observed, mainly on rocky substrate, such as *Acanthogorgia* spp., *Callogorgia verticillata*, P*seudoanthomastus spp,* cf. *Swifitia dubia* and many corals of the family Stylasteridae. Many sponges were observed during the dives of the day, with records of *Phakellia ventilabrum*, *Desmacella grimaldi*, *Regradella phoenix*, *Asconema fristedti,* and the common deep-sea sponge *Pheronema carpenteri*. The second dive (the deepest of the day) had only sandy and coral rubble bottoms, and a very low presence of benthic megafauna. Nevertheless, it was possible to notice some *Cidaris cidaris*, the anemone of the genus *Liponema,* and the fishes *Lepidopus caudatus*, and some individuals from the Macrouridae family. Throughout all dives, the fishes observed were mainly from the genus *Chaunax*, and the species *Hoplostethus mediterraneus*, *Molva macrophthalma* and a ray of the species *Dipturus intermedius*, all seen in the last dive. We decided to end the day at 16h45 and return to Ponta Delgada harbour to load and prepare the boat for the trip to Faial, happening on the following day. We said goodbye to the MT Physeter crew and had dinner at the local pizzeria “Nonnas teeth”.

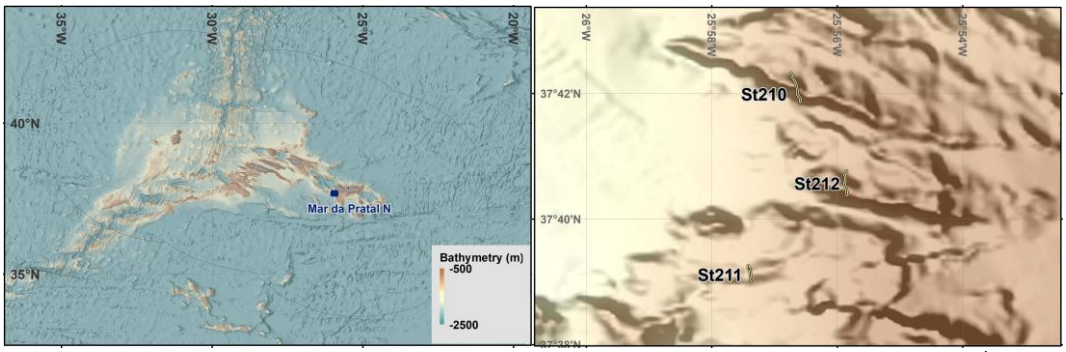


Figure 137. Location of Mar da Prata N and the dives conducted with the Azor drift-cam in this area, 13th September 2023.

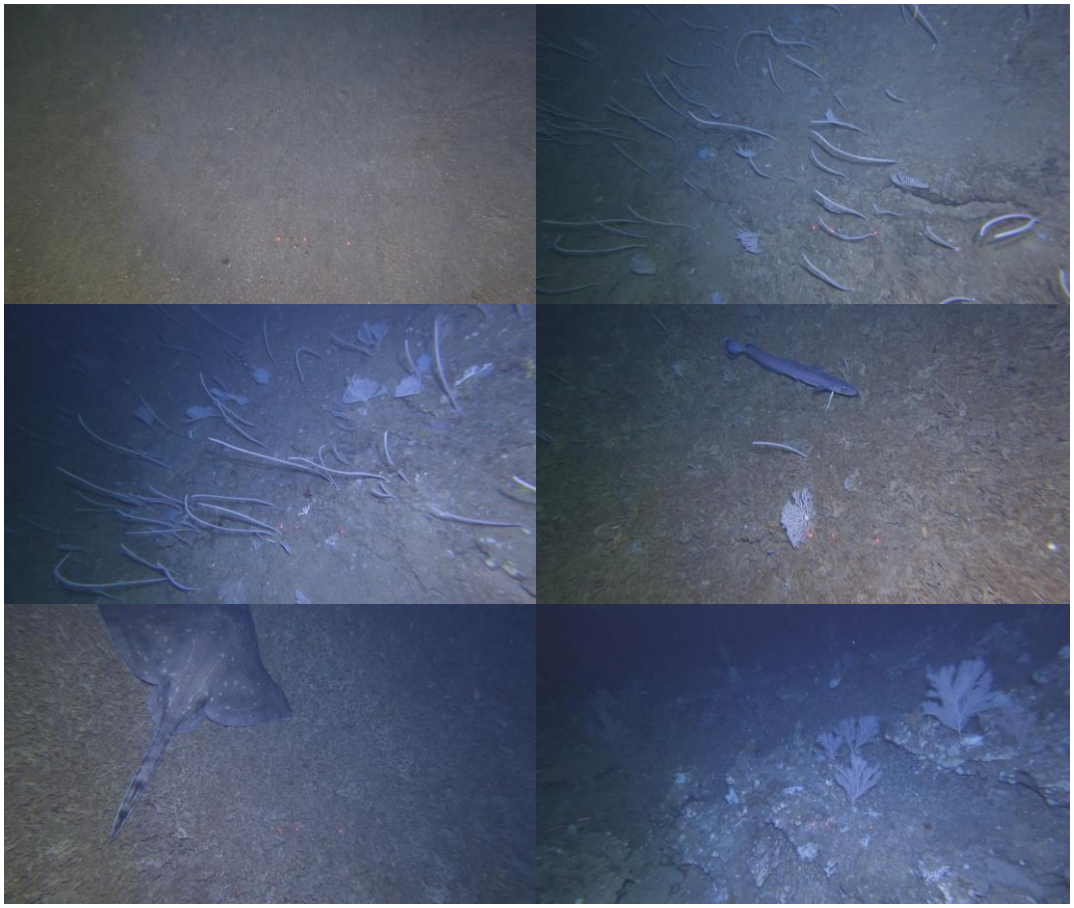


Figure 138. Screenshots extracted from the video footage recorded with the Azor drift-cam in Mar da Prata N, 13th September 2023.

14 September 2023

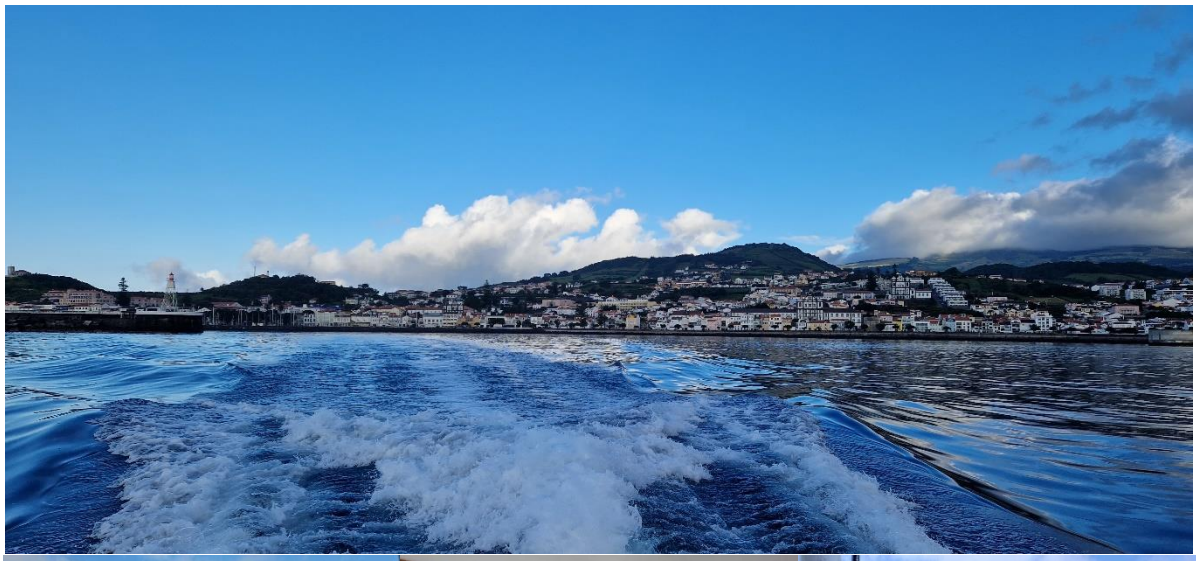
The MT Physeter set sail to Faial Island very early in the morning, trying to avoid the very challenging weather conditions that were predicted for the next few days in the archipelago due to the junction of two depressions. With a flight scheduled for the following day, the scientific team stayed on land, and took the opportunity to update the missions report, make some frame grabs of the dives performed and a preliminary video analysis. During the afternoon, the team went for a walk in the beautiful Furnas area and prepared their luggage getting ready for the trip back home of the next day.

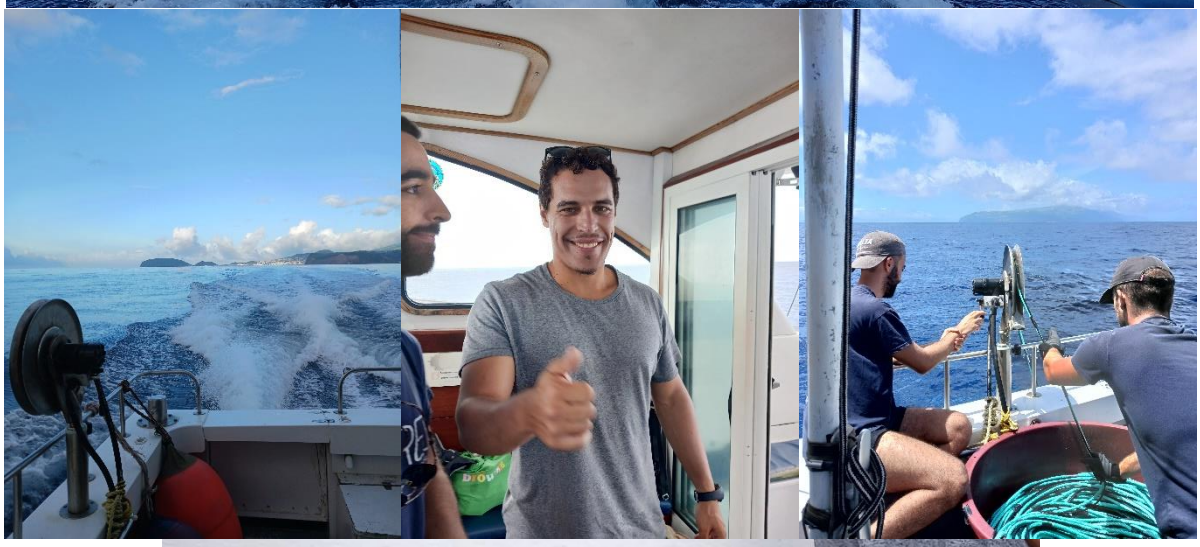
15 September 2023

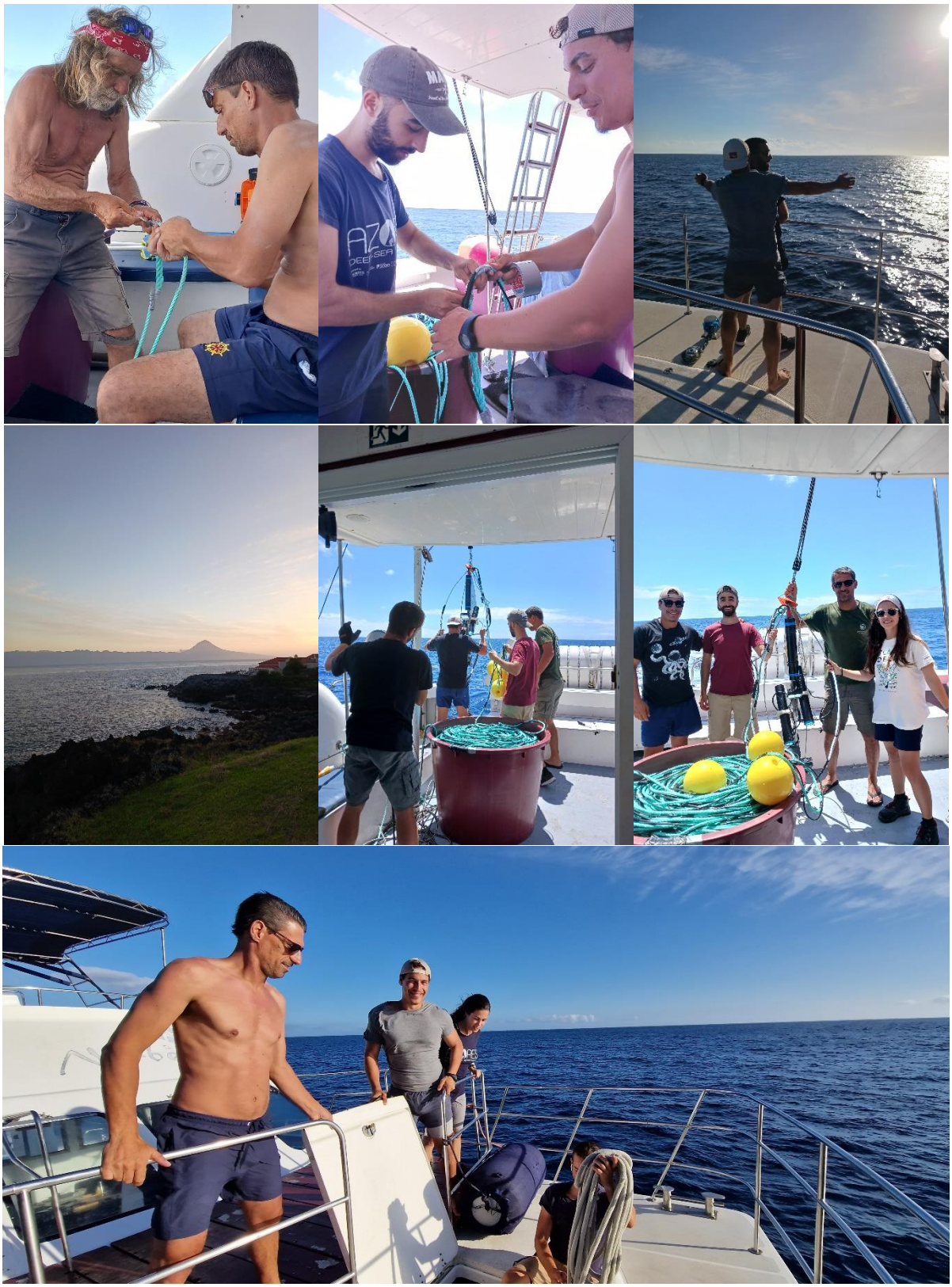
After the arrival of the MT Physeter in Horta on the previous day, some member of the ADSR group met with the skipper to unload all out equipment from the boat. The process took about two hours and after that, all the gears used during Leg 5 were serviced and properly stored in our storage room.

2.6 "LIFE" ON BOARD MT PHYSETER DURING MAPGES 2023 PART 2

2.6.1 "Life" on board MT Physeter during MapGES 2023 Leg4







2.6.2 "Life" on board MT Physeter during MapGES 2023 Leg 5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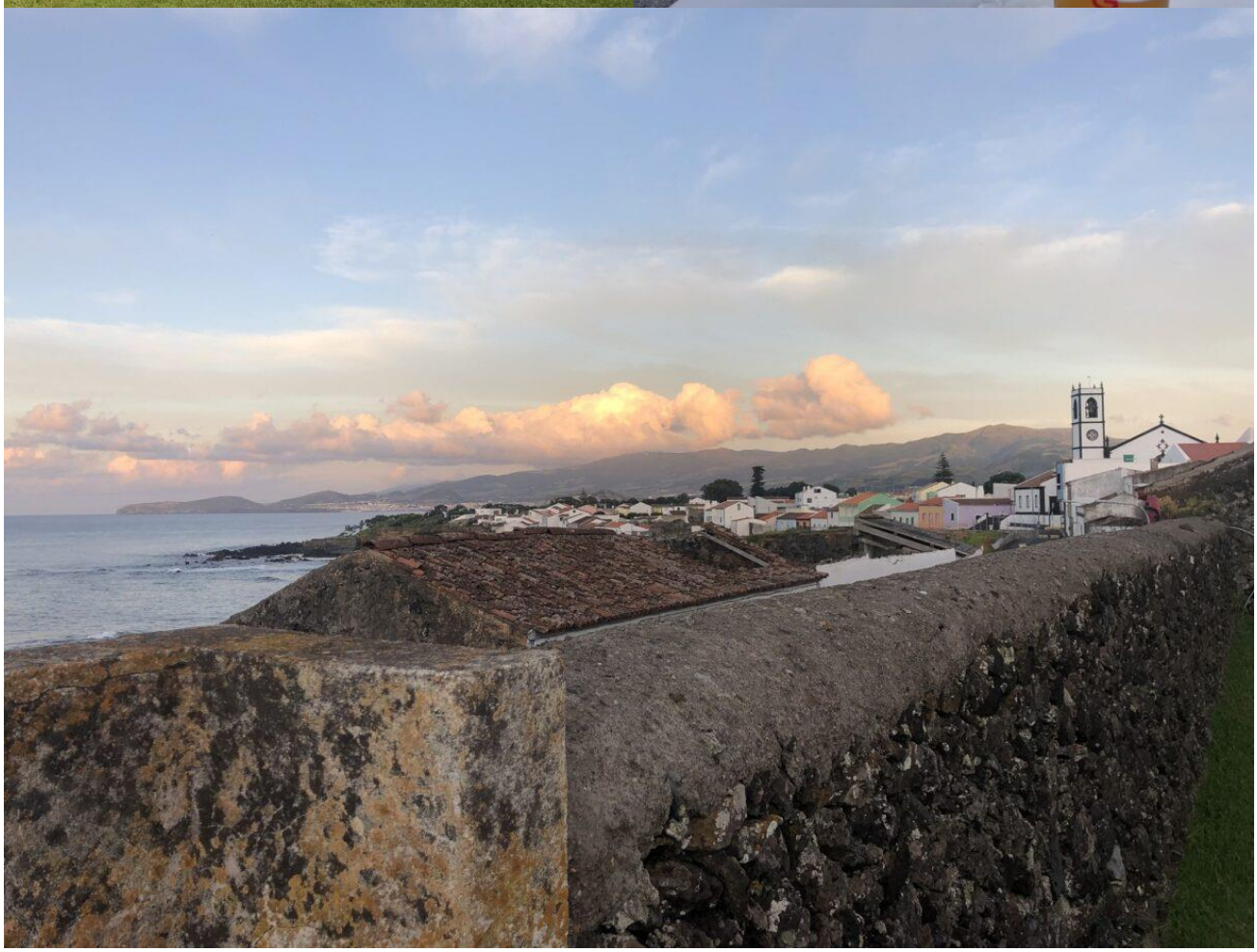

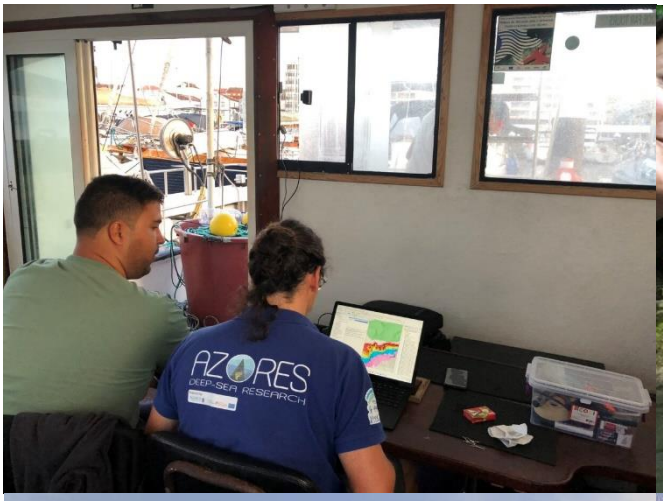
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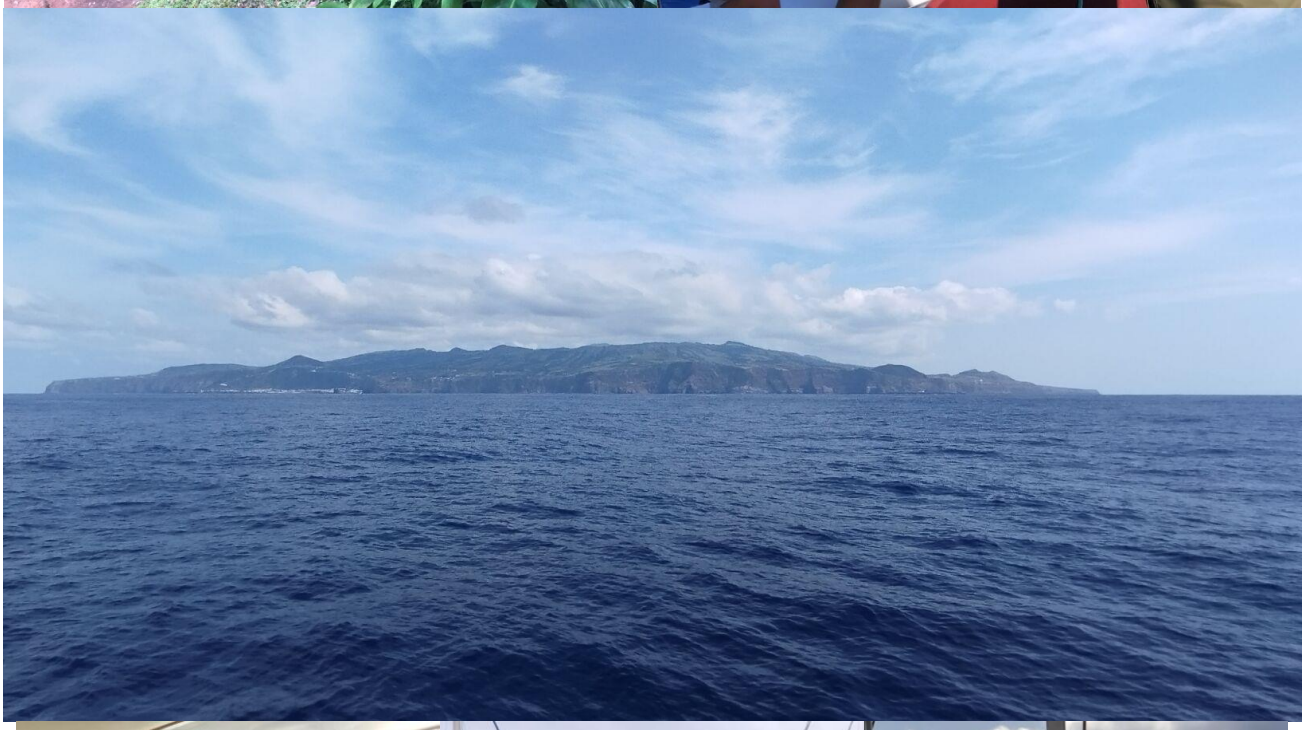
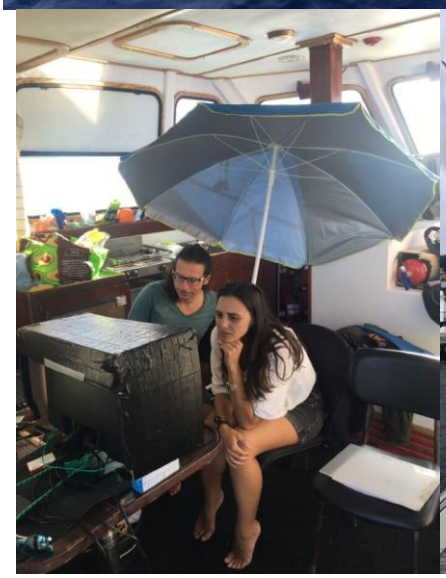

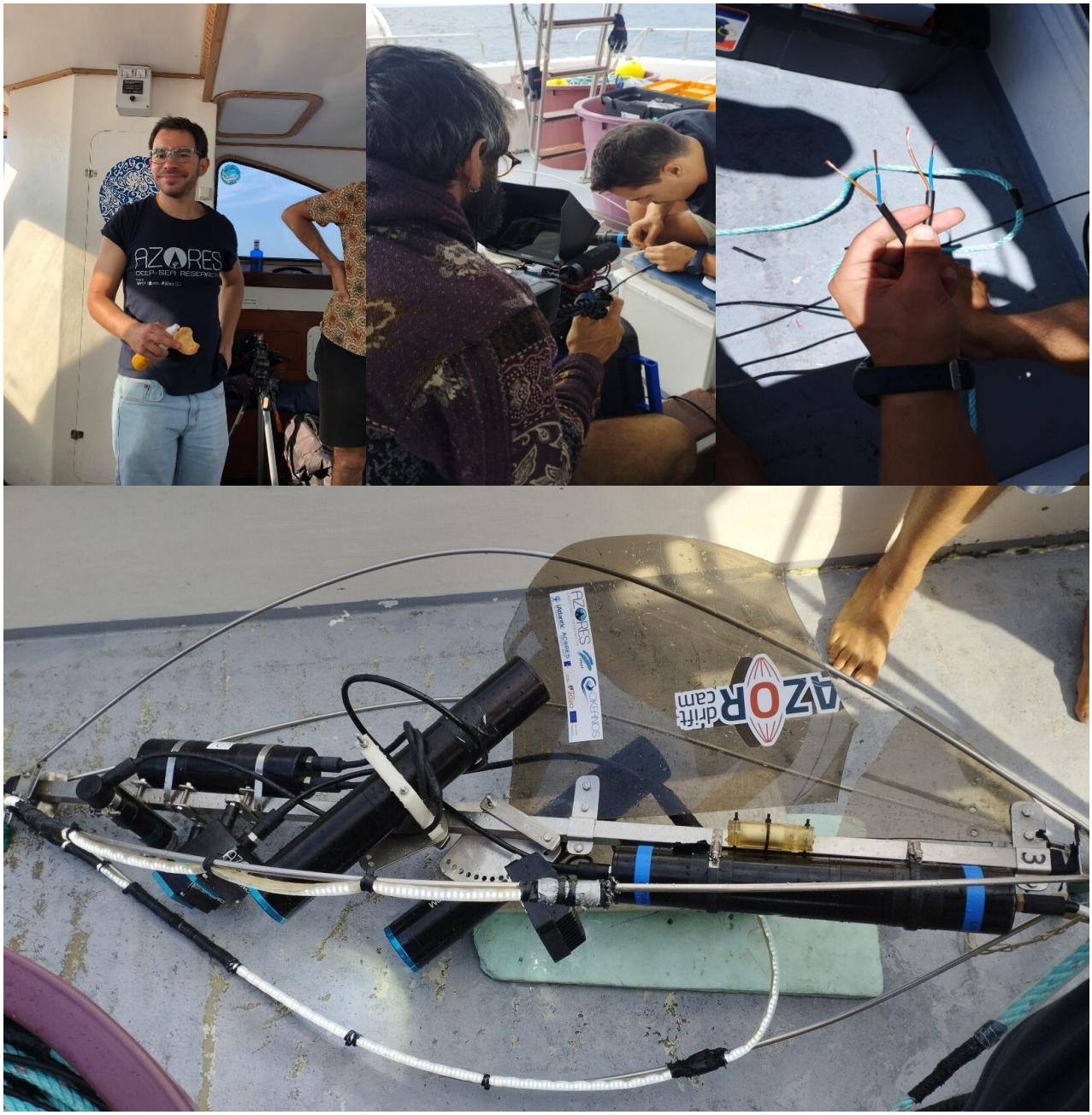
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AZOR drift cam


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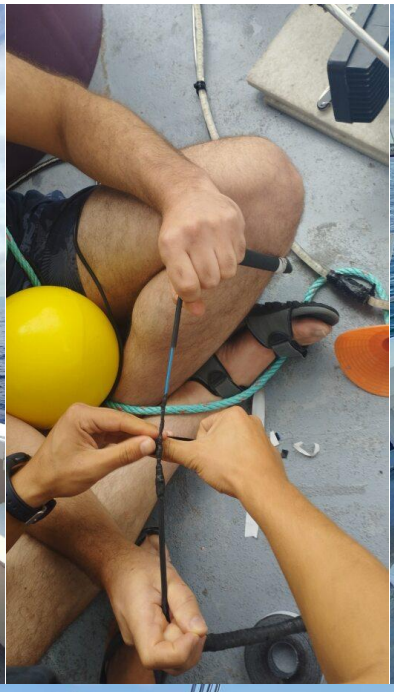
12/09/2023 10:15:39
WHALE WATCHING
SCUBA DIVING
PORTUGAL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3 ACKNOWLEDGEMENTS

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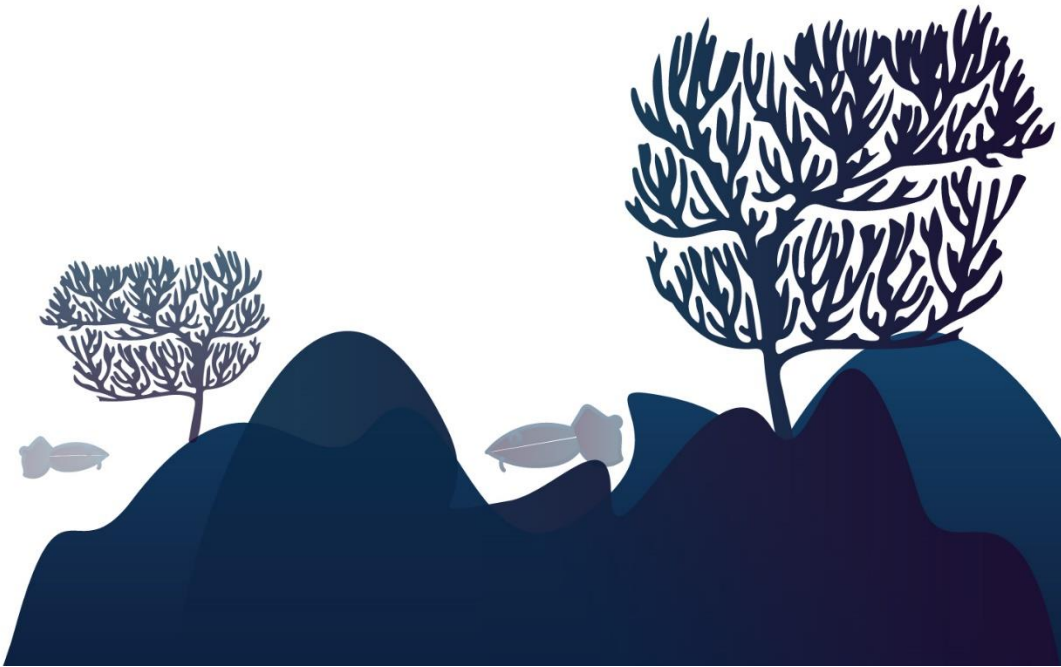
Referência: Morato, T., G.H. Taranto, L. Fauconnet, L. Rodrigues, J. Balsa, I. Areosa, I. Bruno, I. Carneiro, N. Collazo, A. Godinho, S. Gomes, G. Gonçalves, A. Morais, M. Pladevall, M. Ramos, A. Rosa, M. Carreiro-Silva, C. Dominguez-Carrió (2023). MapGES 2023 cruise report: Exploration and mapping of deep-sea biodiversity in the Azores on board the MT Physeter. Instituto de Investigação em Ciências do Mar - Okeanos, Universidade dos Açores, Horta, Portugal. 157pp. DOI:10.5281/zenodo.10787943



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