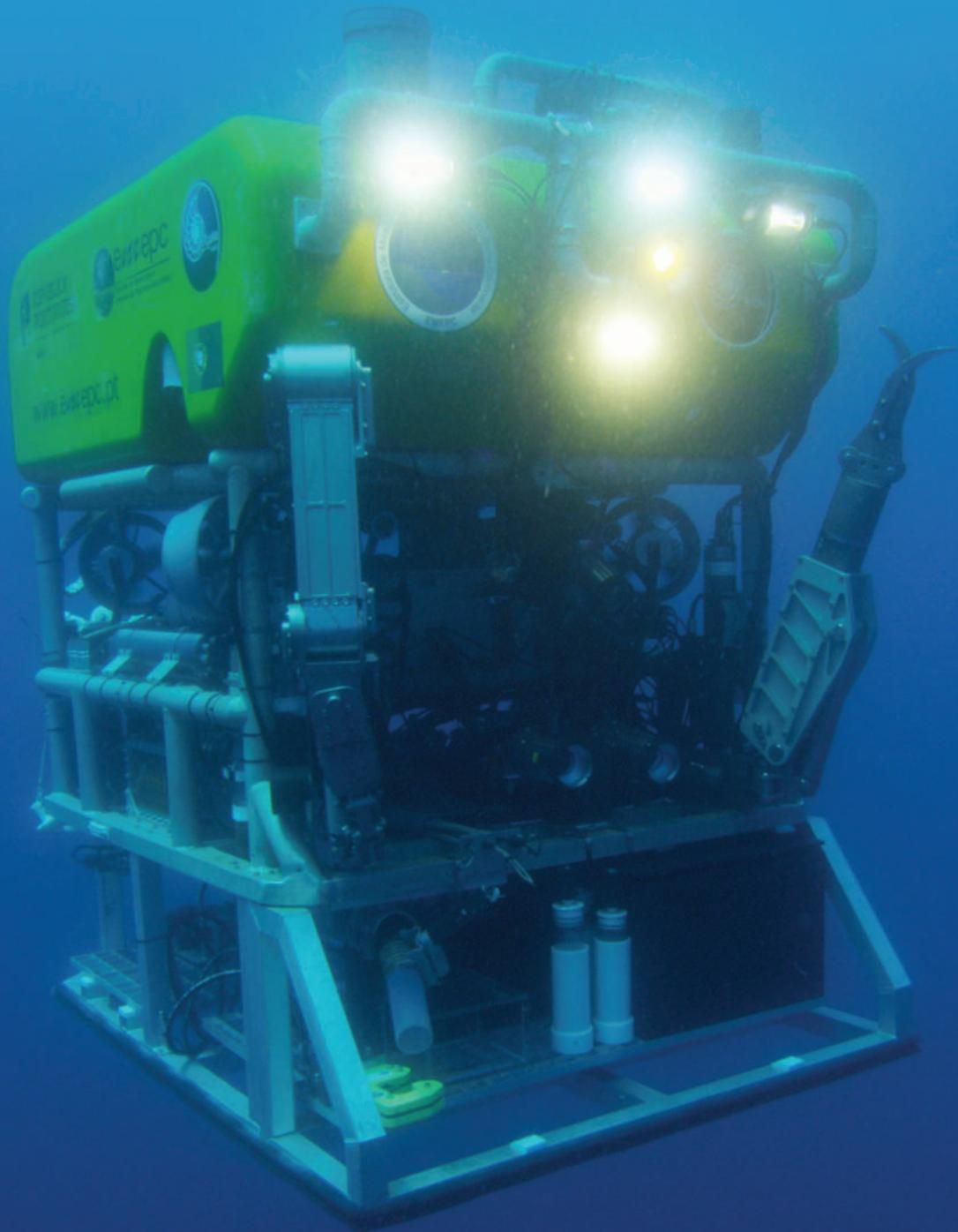




BLUE AZORES
THE BEST KEPT SECRET IN THE ATLANTIC

**SCIENTIFIC REPORT TO THE REGIONAL
GOVERNMENT OF THE AZORES**

2019 | SHORT SUMMARY



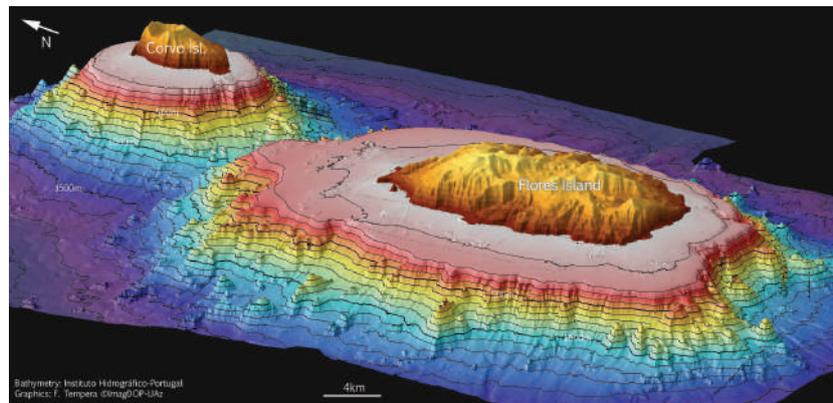
HOW TO CITE THIS REPORT

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The waters around the Azores Archipelago contain some of the most important island, open-water, and deep-sea environments in the Atlantic. Despite its importance, this invaluable, fragile, and irreplaceable blue natural capital is under threat and needs to be protected.

FIGURE 1.

During the 2018 expedition, over 21000 km² of seafloor was mapped in detail for the first time by the Hydrographic Institute's ship Gago Coutinho - an example of seafloor mapping around the islands of Flores and Corvo.



The Blue Azores has a vision to facilitate the Azores in becoming a model economy for a blue society where the natural capital is protected, valued, and promoted through sustainable use of marine-associated businesses and civil society sectors, with effective conservation actions across all the marine environment. For that purpose, the Azores Government has partnered with the Oceano Azul Foundation and the Waitt Foundation to implement this vision. The National Geographic Pristine Seas Program is also a partner, together with the University of the Azores, the Institute of Marine Research (IMAR), the Portuguese Hydrographic Institute, the Task Group for the Extension of the Continental Shelf, and many other researchers and research institutions from around the world. Two expeditions were organized, one in 2016 to the eastern group of islands and another in 2018 to the central and western groups. The results of these expeditions along with information from ongoing research efforts in the Azores show a vibrant and diverse marine ecosystem, but one that is under great pressure from numerous human threats.

INTERTIDAL COMMUNITIES

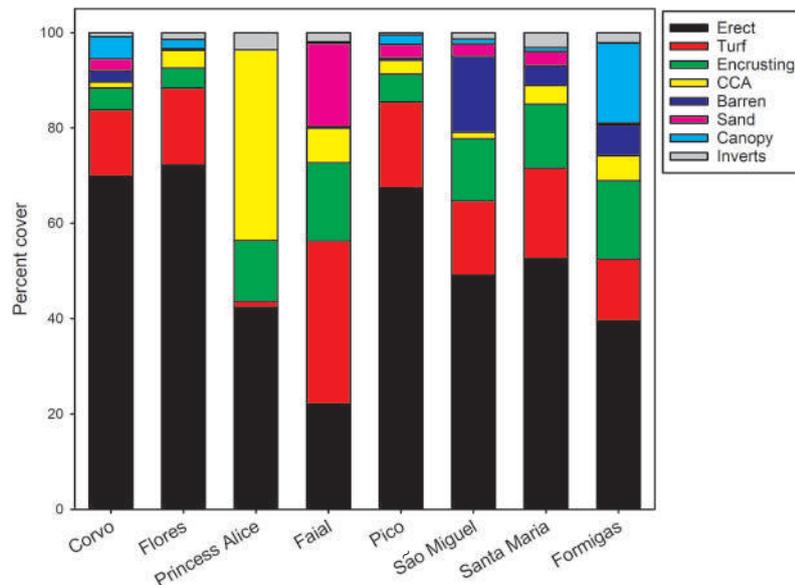
Rock pools are essential fish habitat for numerous fishes and invertebrates in the Azores, including juveniles of the endangered dusky grouper *Epinephelus marginatus*. These habitats are under increasing pressure and need to be protected. Limpets *Patella candei* (intertidal) and *P. aspera* (mostly infralittoral) are commercially important keystone species that have been intensely exploited and populations have nearly collapsed.

BENTHIC COMMUNITIES

Algal assemblages at deeper depths (~20 m) were dominated by the brown alga *Zonaria tournefortii*, while the assemblages at shallower depths (~10 m) were more variable, with the dominance changing depending on site. Princess Alice Bank was most distinct from the islands. Faial had a distinct benthic community with sand and turf algae being most abundant. Erect algae were most closely correlated with Corvo, Flores, and Pico. Formigas, and Santa Maria were very similar based on benthic functional groups. Formigas had the highest algae biomass, consisting primarily of dense canopy-forming macroalgae *Cystoseira* and *Sargassum* beds. In deeper waters (> 45m) of this seamount, the occurrence of kelp (*Laminaria ochroleuca*) beds have been documented. Some invasive algae species, including the genus *Asparagopsis* are abundant throughout the archipelago.

FIGURE 2.

Benthic functional groups by island. Erect = erect macroalgae, Encrusting = encrusting macroalgae, CCA = crustose coralline algae, Canopy = canopy-forming macroalgae (e.g., *Cystoseira* and *Sargassum*).

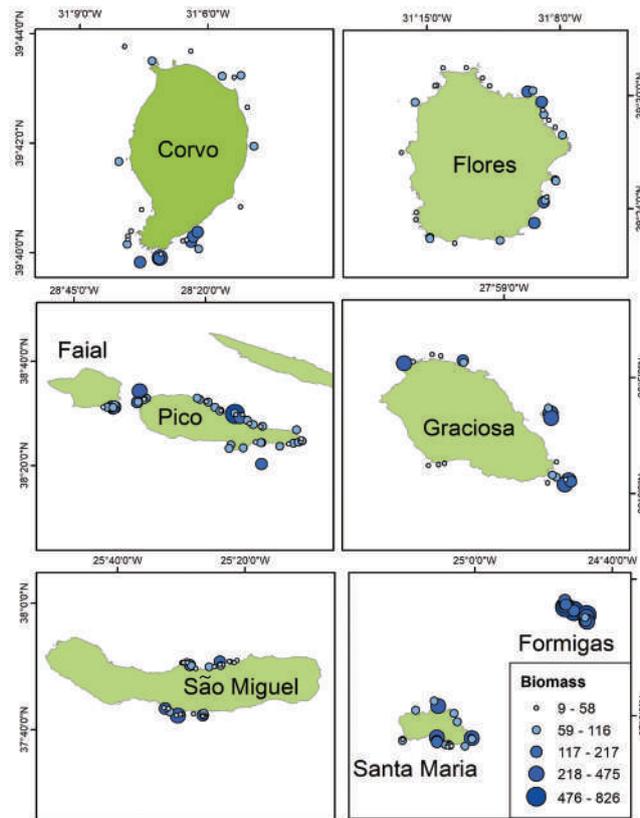


COASTAL FISHES

The number of coastal reef fishes varied between islands, with the highest species richness observed at Formigas and Faial and the lowest at Flores and Corvo. Fish biomass was also higher at Formigas and Faial and lower at Flores and São Miguel. The largest fish biomass was observed at Formigas and inside the Corvo voluntary reserve, which are strongly protected marine areas. Overall fish biomass in the Azores is comparable to heavily fished areas in Madeira and the Canary Islands (Friedlander *et al.* 2017). Very few top predators were present. Pressure on coastal resources seems to be the main cause for these low levels of biomass, with the use of nets widespread on the shelves of some islands.

FIGURE 3.

Fish biomass (g m^{-2}) by sampling location throughout the archipelago.



To track the movement of the endangered dusky groupers (*E. marginatus*) around Corvo Island, seven fish captured inside the voluntary reserve were acoustically tagged and released. All fish resided inside this small reserve for a 2-month period showing the effectiveness of fully protected MPAs for the conservation of this species.

FIGURE 4.

The dusky grouper, *Epinephelus marginatus*, is listed as Endangered by IUCN and is benefiting from protection in a few locations in the Azores (e.g. Corvo voluntary reserve and Formigas).



NEARSHORE SHARK NURSERIES

Nearshore occurrences of the smooth hammerhead shark (*Sphyrna zygaena*) and tope shark (*Galeorhinus galeus*) were documented through acoustic telemetry, baited remote underwater video systems, and interviews with fishers and researchers. Hammerheads are seen mostly during summer months, with small groups of juveniles frequently spotted on the south coast of Flores Island. Larger groups of this species are found at Faial, Graciosa, and Santa Maria (usually on the north shores), with up to 20 individuals of approximately 1-1.5 m in length occurring together. Telemetry is showing that they reside in the islands during their whole juvenile phase. Occasionally large pregnant females have been detected.

FIGURE 5.

Sub-adult smooth hammerhead sharks on Faial's north shore



MESOPHOTIC REEFS

Mesophotic reef ecosystems (30-150 m) have received relatively little attention owing to the difficulty in studying these deeper habitats. Baited remote underwater video systems (BRUVS) were used to assess these communities. We discovered previously unknown mesophotic communities hosting fragile habitat-forming species of high conservation value such as hard corals, gorgonians, tall leptothecate hydroids, and large sponges. Surprisingly, no sharks were observed in these mesophotic reefs, which should be a refuge for these species. The Azores mesophotic reefs are rich in species and deserve special attention since most are not covered by effective conservation measures, and the scarcity of large predatory fishes in these reefs could be a sign of significant fishing impacts.

FIGURE 6.

Mesophotic baited remote underwater video systems (BRUVS) showing *Raja* sp. at 110 m.



MID-WATER COMMUNITIES

We sampled the pelagic communities across the western and central groups of the Azores. The most abundant species were small forage fishes: longspine snipefish (*Macroramphosus scolopax*), boarfish (*Capros aper*) and mackerel (*Trachurus* sp.). Sharks were observed regularly, with blue sharks (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*) observed at 32% and 23% of sites, respectively.

FIGURE 7.

Shortfin mako sharks (*Isurus oxyrinchus*) were observed at 23% of pelagic sampling stations.



FIGURE 8.

Glaucus atlanticus is a pelagic sea slug that also has a global distribution. It is able to feed on the Portuguese man o' war due to its immunity to the venomous nematocysts.

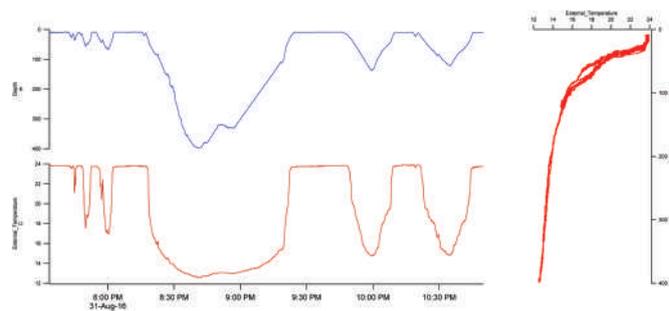


DEVIL RAY BEHAVIOUR

Devil rays (family Mobulidae) are iconic, endangered animals and despite their large size, their elusive behaviour has limited our understanding and conservation of these species. The Azores constitutes the northernmost limit for mobulid rays in the Atlantic and globally. Three devil rays were tagged in 2016 at Baixa do Ambrósio (Santa Maria) and Formigas Seamount, using a new non-invasive harness method, deployed on free swimming animals by a free-diver. The maximum descent rate registered was 2.72 m/s and the maximum recorded depth of 400 m. Devil rays are known to dive very deep (over 2000 m) and visit the seamounts of the Azores in the summer, travelling all the way from the west African coast. It is speculated that they visit the Azores to give birth and likely to mate.

FIGURE 9. | 10.

Chilean devil rays (*Mobula tarapacana*) and depth and temperature profiles for a devil ray tagged at Formigas Seamount.



SEABIRDS AND ASSOCIATED MEGAFaUNA

The Azores is a global hotspot for seabirds. There are 10 known breeding seabird species found here including: Cory's shearwater (*Calonectris borealis*), Manx shearwater (*Puffinus puffinus*), Macaronesian shearwater (*Puffinus lherminieri*), band-rumped storm-petrel (*Hydrobates castro*), Monteiro's storm petrel (*Hydrobates monteiroi*), Bulwer's petrel (*Bulweria bulwerii*), common tern (*Sterna hirundo*), roseate tern (*Sterna dougallii*), yellow-legged gull (*Larus michahelis atlantis*) and sooty tern (*Onychoprion fuscatus*).

FIGURE 11.

Cory's shearwater (*Calonectris borealis*) was the most abundant seabird species recorded and is known to forage an average of 75 km from the colonies on short-term trips and up to 1800 km on long-term trips.



Standard observations of seabirds, marine megafauna, and marine litter were conducted along 54 transects, over 39.5 hrs and covering 822 km of the western group of the Azores. Nine species of seabirds were observed, of which eight are known to breed in the Azores. Six sperm whales (*Physeter macrocephalus*), two humpback whales (*Megaptera novaeangliae*), a fin whale (*Balaenoptera physalus*), two unidentified baleen whale species, 35 bottlenose dolphins (*Tursiops truncatus*) and 160 common dolphins (*Delphinus delphis*) were registered during these surveys. A single loggerhead turtle *Caretta caretta* (~32 cm carapace length) was detected in 20 surveys.

FIGURE 12.

Sperm whale (*Physeter macrocephalus*) is the largest predator on the planet and an abundant species off most Azores Islands.

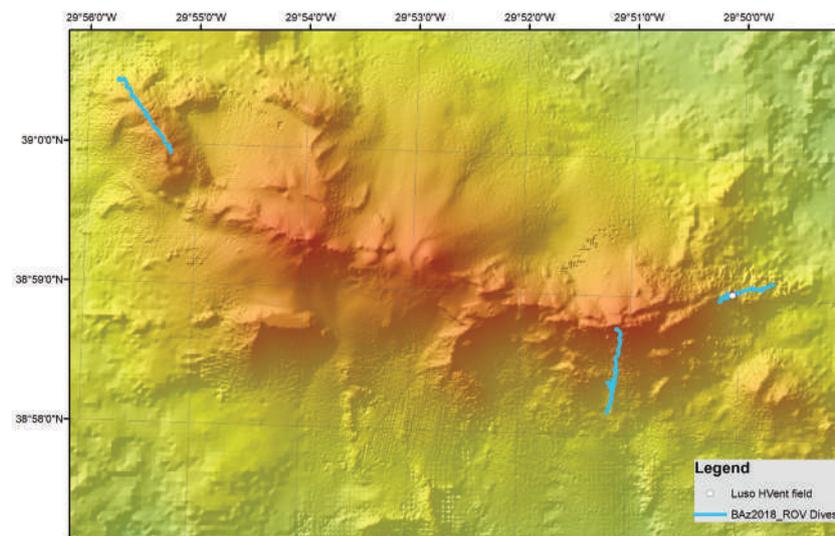


DEEP-SEA ASSEMBLAGES

The seafloor of the Azores EEZ is characterized by complex topography comprising island slopes, seamounts, deep fracture zones, trenches, and abyssal plains exceeding 5000 m. During the 2018 expedition, over 21000 km² of seafloor was mapped in detail for the first time. There are 300+ seamounts in the Azores that provide ideal conditions for the occurrence of cold-water corals and sponges, which are listed as Vulnerable Marine Ecosystems. Most of these seamounts are still unexplored scientifically, but some have been exploited by bottom trawls in the past and are impacted by other benthic fishing gear as well. Many of these deep-water species are slow growing, long-lived, and have low reproductive outputs, making them extremely vulnerable to fishing and other human impacts, with recovery times requiring decades to centuries. Cold-water coral diversity is particularly high in the Azores, with 184 species identified to date.

FIGURE 13.

Map of the Gigante seamount showing the "Luso" hydrothermal vent field (white dot) discovered during the 2018 Expedition.



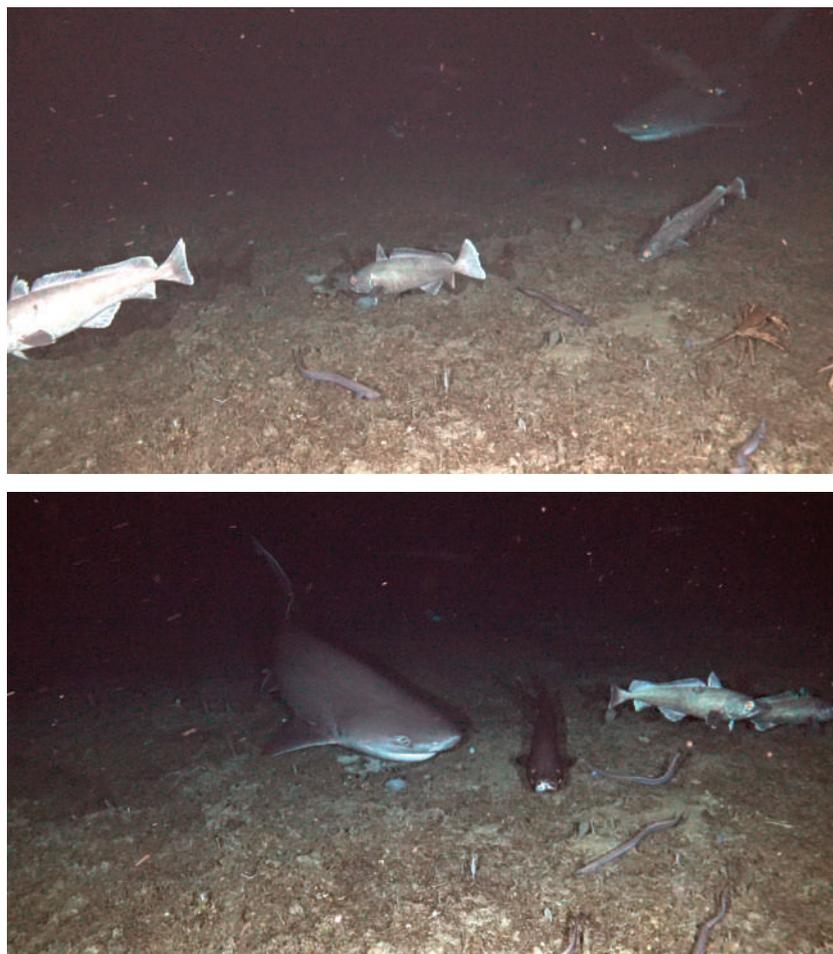
Some of the vertical walls explored with the remotely operated vehicle Luso, both at São Jorge and Pico islands, hosted unique assemblages characterized by the presence of the long-lived oyster cf. *Neopycnodonte zibrowii* (lifespan of several centuries) and the sessile crinoid *Cyathidium foresti*. This assemblage has been described as a 'living fossil community'. The fragile nature of this habitat and uniqueness in the North Atlantic justifies its protection. South of Pico, dense aggregations of large glass sponges (*Pheronema carpenteri*) were also observed.

National Geographic's Exploration Technology Lab deployed Deep-Ocean Dropcams from 240 to 1480 m during 39 deployments in the western Azores in June 2018. Rockfishes (Sebastidae), cutthroat eels (Synphobranchidae), grenadiers (Macrouridae), and the mora (*Mora moro*) were the most common fish families observed at these deeper depths. Lanternfishes (Myctophidae) and porgies (Sparidae) were the most

numerically abundant families of fishes observed. Sharks, rays, and skates occurred on 74% of the deployments and were present on all 10 of the deepest deployments (> 1000 m). The Bluntnose sixgill shark (*Hexanchus griseus*) and the Portuguese dogfish (*Centroscymnus coelolepis*) were seen most frequently at these depths. Other observed taxa included lantern sharks (Etmopteridae) and dogfish (Centrophoridae). The observed fish assemblages of the deepest deployments (1000 - 1480 m) were characterized by eels (Anguilliformes), cods (Gadiformes), and sharks (Elasmobranchii).

FIGURE 14.

Fishes from the family Moridae and sharks at Cachalote Seamount.



Mobile invertebrates including brachyuran crabs, shrimps, squid, chaetognaths (arrow worms), sea stars, and sea urchins (including *Cidaris cidaris*) were also encountered on the dropcams. Sessile invertebrates included black corals (*Bathypathes* cf. *patula*), octocorals (including *Viminella flagellum* and *Paracalyptrophora josephinae*), stony corals (*Dendrophyllia cornigera*), anemones (including *Cerianthus* sp.) and deep-sea sponges (Porifera).

FIGURE 15.

National Geographic's
Deep-Ocean
Dropcams.



HYDROTHERMAL VENT FIELD

The Gigante Complex Area is located between the islands of Flores and Faial and sits over the Mid-Atlantic Ridge. One major discovery of the 2018 expedition was a new hydrothermal vent field on the slopes of Gigante at 570 m. This hydrothermal vent field was named “Luso” and occupies an area of about 400 m² being composed of at least 26 chimney-like structures of different sizes with orifices up to 30 cm in diameter. A total of 28 taxa were identified from 8 different phyla. Preliminary characterisation of the Gigante Seamount region has identified at least 200 different benthic species with the best represented taxonomic groups being Cnidaria (80 taxa), Porifera (60 taxa) and Actinopterygii (34 taxa).

FIGURE 16.

Chimney like
structures in the Luso
hydrothermal vent field



The SW ridge of this area hosted the most extensive and densest bubblegum (*Paragorgia* spp.) coral garden identified so far in the Azores. Some colonies reaching over 1 m in height and 1.5 m in diameter have an estimated age of over one century and were still pristine, while others showed signs of significant impacts by bottom longlines. The density, size, uniqueness, and fragility of the *Paragorgia* spp. populations observed makes this area a good candidate for a Vulnerable Marine Ecosystem.

FIGURE 17.

Coral garden of *Paragorgia* spp. at the Mid-Atlantic Ridge.



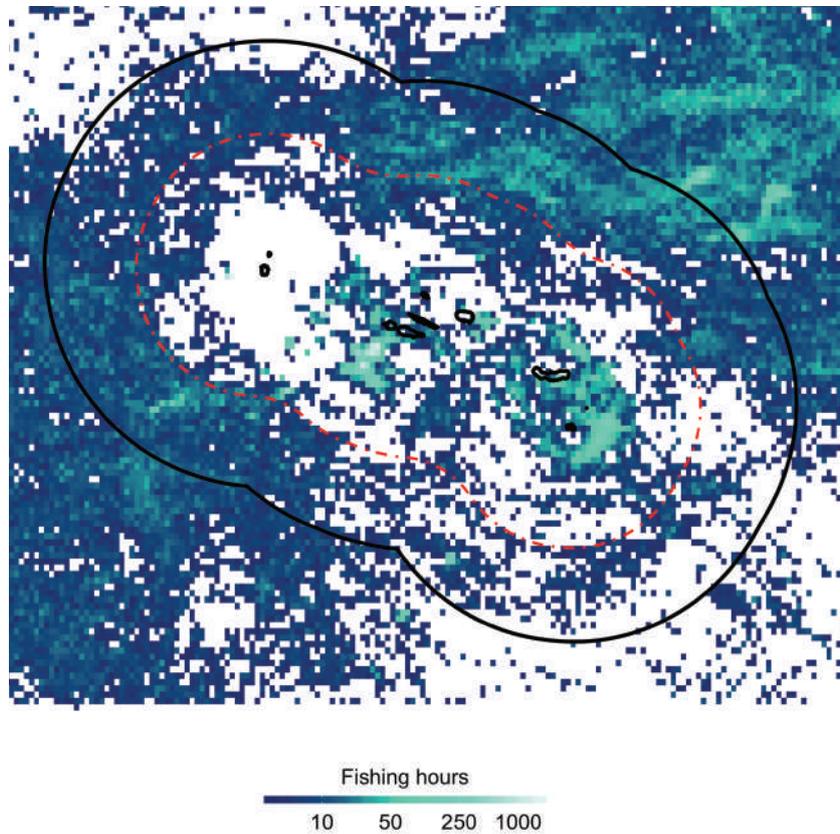
COMMERCIAL FISHING IMPACTS

The Azores have one of the largest no-trawling areas in the world and therefore the main threats are related to longlines, nearshore overfishing, and poaching. The current fully protected areas are very small and therefore most ecosystems are impacted primarily by commercial fishing. Fishing activity within the Azores EEZ is non-uniformly distributed, with hotspots around São Miguel and Santa Maria, and the Princess Alice and Açor banks.

Drifting pelagic longlines are the predominant fishing gear used by both Portuguese and Spanish-flagged vessels and accounted for 47% of all fishing effort in 2018. This fishing gear mainly targets billfishes and pelagic sharks, such as blue and mako. The second and third most used fishing gears are pole and line and set bottom longlines, representing 34% and 15% of total fishing effort, respectively. These are predominantly used by the regional fleet.

FIGURE 18.

Total fishing effort inside and outside Azores' EEZ (2017-2018). Black line indicates EEZ limits, red dashed line indicates the 100 nm limit.



Overall, the footprint of fishing within the Azores' EEZ is large and covers most of the region's waters. This is especially true of the outer 100 nm of the EEZ where nearly 40 Spanish-flagged drifting longliners fish for up to 1000 vessel-days per year. Catches of billfishes and sharks have nearly tripled since the 1950s. Blue sharks comprised 8% of the total longline catch in the 1960s but increased to 70% in the 2000s, whereas the catch of benthopelagic fishes such as the valuable black seabream have declined five-fold since 1950. Porgbeagles (*Lamna nasus*) accounted for 88% of the shark catch in the 1960's but now account for < 1%. These results call for urgent implementation of large-scale fully protected MPAs and much more effective fisheries regulations measures throughout the region.

RECOMMENDATIONS

There are four priorities to advance conservation policies in the Azores and allow the region to benefit from the long term and sustainable use of its sea.

1.

Significantly increase the proportion of the Azores EEZ under full protection, aiming at including the most valuable species and ecosystems, including species of high commercial and cultural value. This should focus on coastal habitats, seamounts, open-water ecosystems, and the deep-sea. With < 1% of the Azores seas under full protection, this is a top priority for the region.

2.

Fully implement the existing conservation areas by developing management plans that fully or strongly protect these areas and allocate the necessary financial and human resources to properly manage them. Current scientific studies, including the expeditions' results presented in this report, show no clear conservation benefits from the existing MPAs except where they are strongly protected.

3.

Develop additional fisheries measures that promote the sustainable local fisheries and eliminates destructive and unsustainable fishing practices such as the use of pelagic longline fishing, coastal gillnets, and the impacts of set longlines on seamounts and benthic communities.

4.

Promote education and ocean literacy throughout the archipelago and to the wider Portuguese society in support of the conservation measures proposed in the report. Awareness of the threats facing the Azores seas and of the effectiveness of the solutions to mitigate these threats, will be required to support government action, adoption of conservation and sustainable fishing measures by the different authorities, and compliance by all ocean users.

A number of specific recommendations to achieve these four priorities are included in the conclusions of the full report.

FOR MORE INFORMATION, PLEASE CONTACT

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