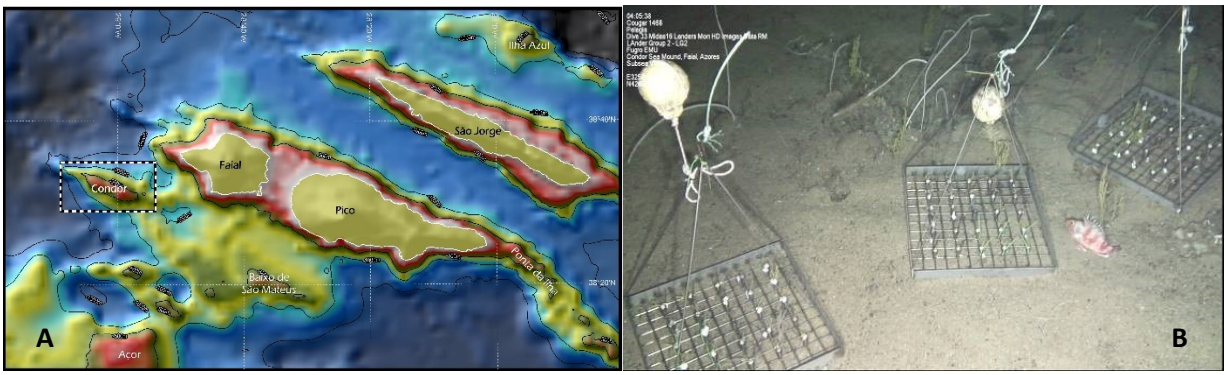
Milestone 13: “Deep-sea organism to be transplanted for the active restoration pilot study collected”

The main objective of the Azores case study within WP4 of the MERCES project is to develop methodologies and tools for restoration of degraded deep-sea coral gardens. The main pilot action consists in testing the use of cold-water coral transplantation techniques as an *active restoration* tool, also called *assisted regeneration*, to aid the recovery of coral gardens potentially impacted by human activities (e.g. deep-sea fishing, seafloor mining).

Fragments of the octocoral *Dentomuricea meteor,* a common species in coral gardens in the Azores, were collected, maintained in the lab, and transplanted to the summit of Condor seamount (Fig 1a) using fauna landers. This first trial started in July 2016 during a field cruise onboard the RV *Pelagia* to the Condor Seamount, funded by the FP7 MIDAS project (Managing Impacts of Deep-seA reSource exploitation) (Fig 1b). The first set of landers (3 out of a total of 9 landers) was successfully retrieved in March 2017 using IMAR-UAz’s ROV SP (Fig 1c). The landers were located by the ROV, hooked and pulled on board the vessel Águas Vivas (Fig 1d, 1e, see video). The remaining sets of landers will be collected during the summer of 2017 and 2018.



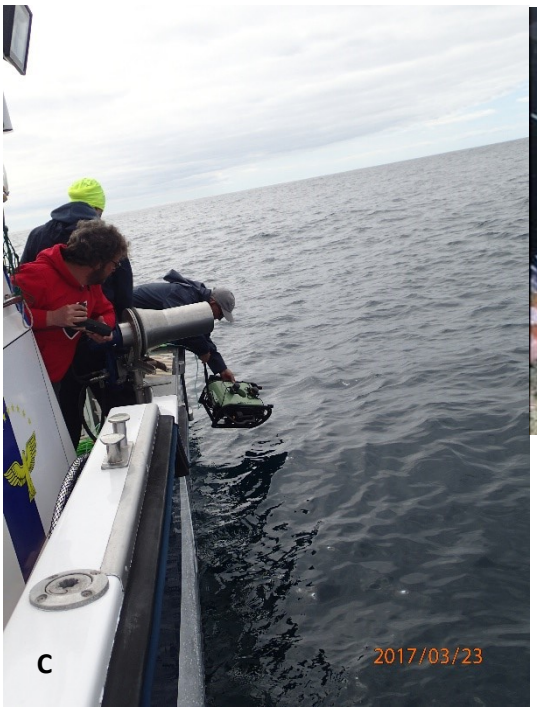


Figure 1. (a) Condor Seamount in the Azores Archipelago; (b) landers used in the coral transplantation experiments right after deployment; (c) lander retrieval using IMAR UAz ROV SP; (d) landers found and hooked to the ROV; (e) transport of the landers to the onboard aquarium

Upon arrival onboard, landers were immediately placed in containers with cooled seawater (Fig 2a), to minimize air exposure. Each coral fragment was photographed onboard the vessel, for future growth rate measurements by comparing these with pre-deployment photographs of the same fragments (Fig 2b).

Figure 2. (a) Detail of a lander with the fragments of the coral *Dentomuricea aff. meteor* immediately after lander recovery ; (b) Photographing coral fragments onboard the vessel Águas Vivas, Azores

The transplantation of a larger and more representative number of cold-water coral species is also being assessed. This work results from a close collaboration with local fisherman and fisheries observers who are bringing different species of cold-water corals accidentally caught as bycatch during their hook-and-line fisheries operations since January 2017 (Fig. 3a). In order to increase their survival, the corals are maintained in a cooler box with seawater onboard fishing vessels (Fig 3b). Upon arrival Horta harbour, corals are transported and maintained at the Deep-Sea Lab aquaria facilities at IMAR-UAz (Fig. 3c).

Figure 3. (a) Longline fishing vessel *Manuel de Arriaga* from Horta, Faial Island, Azores; (b) Antonio Godinho (Deep-Sea Lab technician) and Rodrigo Sá da Bandeira (fisheries observer) discussing the coral transport from the vessel to the Deep-Sea Lab aquaria facilities at IMAR-UAz; (c) detail from the Deep-Sea Lab aquaria facilities at IMAR-UAz

In total we have maintained 8 coral species (Fig 4 and 5), and a total of 32 fragments made from these species. From these, 24 fragments are still being maintained in the aquaria facilities. Based on results of coral survival rates, acclimatization success and number of coral colonies captured as bycatch, transplantation experiments in July 2017 will start with the coral species: *Callogorgia verticillata, Viminella flagellum* and *Dentomuricea aff. meteor* (Fig 5). A larger number of species will be transplanted in subsequent years.

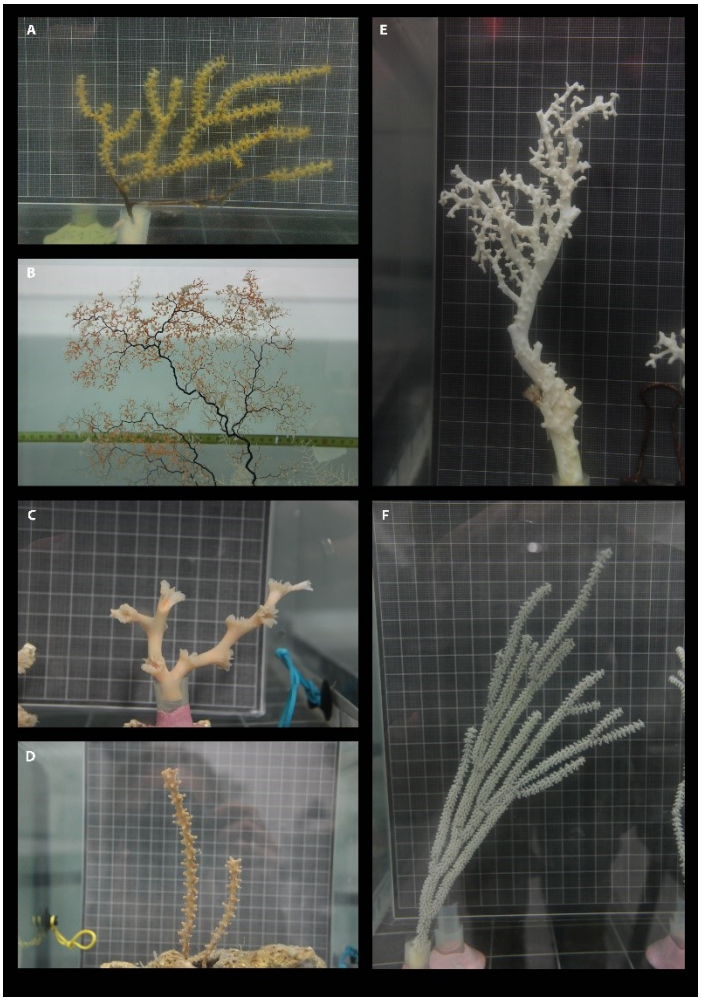


Figure 4. Cold-water corals accidentally caught as bycatch during their hook-and-line fisheries operations in the Azores (a) *Acanthogorgia armata*; (b) *Leiopathes sp*; (c) *Lophelia petrusa*; (d) Plexauridae; (e) *Corallium sp*; (f) *Paracalyptrophora josephinae.*

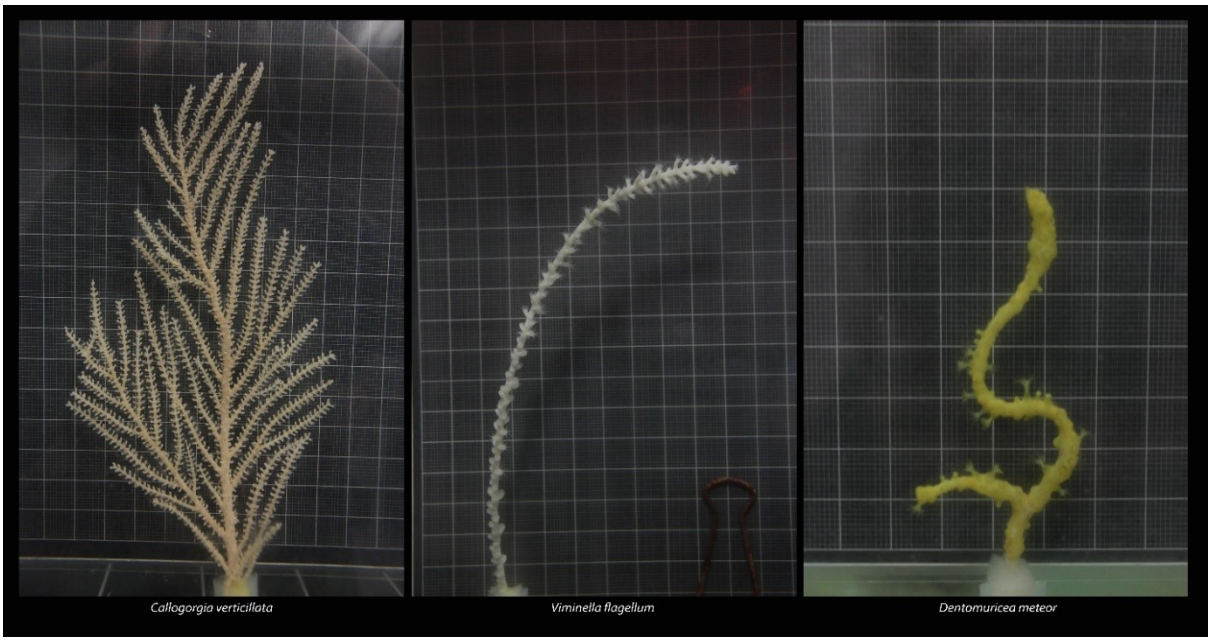


Figure 5.The octocorals *Callogorgia verticillata, Viminella flagellum* and *Dentomuricea aff. meteor*, which will be transplanted to the Condor seamount, Azores in July 2017.