Corso di Dottorato di Ricerca in Scienze della Vita e dell'Ambiente - Ciclo XL

Ecology and restoration of deep-sea marine ecosystems

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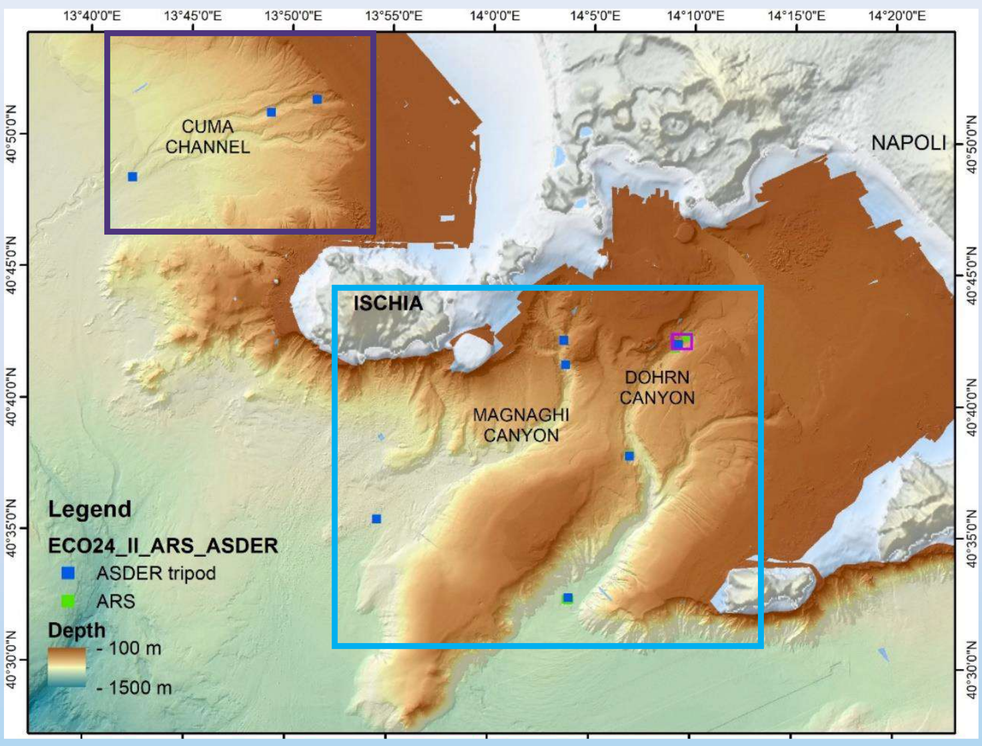
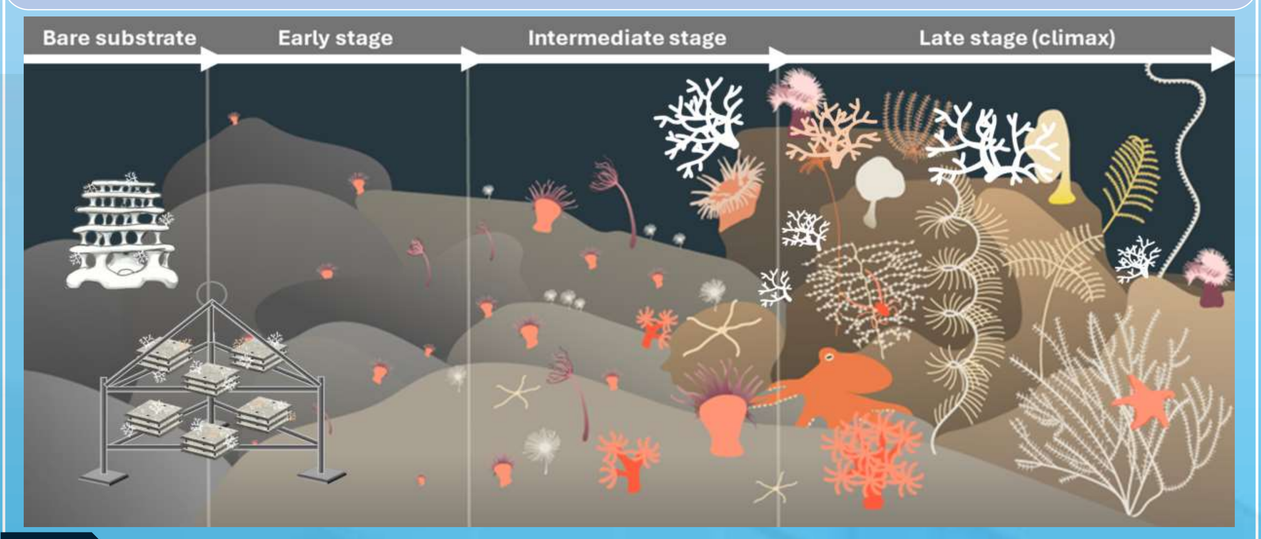
Background

Human activities have multiple negative impacts on marine habitats, including **deep-sea habitats**, subjected to an important habitat degradation, which are expected to have serious consequences on a planetary scale[1,2]. The restoration of **vulnerable marine ecosystems** (VMEs) and deep-sea habitats through the reintroduction of **habitat-forming species** is a priority[1]. Important challenges remain, including a lack of data, expertise and the need for expensive technologies. **Cold water coral reefs** are pivotal VMEs and **biodiversity hotspots** of the deep continental shelf. They increase habitat complexity, sequester carbon and provide habitats and breeding grounds for commercial and iconic species [3]. The canyons that cross the Gulf of Naples (Tyrrhenian Sea), eroding the slope down to 1,000 m, represent a CWC hotspot that has been subjected to human impacts such as illegal dumping and fisheries malpractice for many decades [4]. Therefore, this area represents a suitable location for testing restoration strategies.



Recruitment-based solutions for deep-sea restoration: timing, ecological succession and drivers



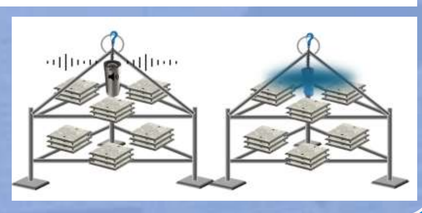
AIM

To provide baseline knowledge about the **timing**, **ecological succession** and environmental **drivers** defining the **colonization** of **artificial structures for deep-sea ecosystem restoration.**

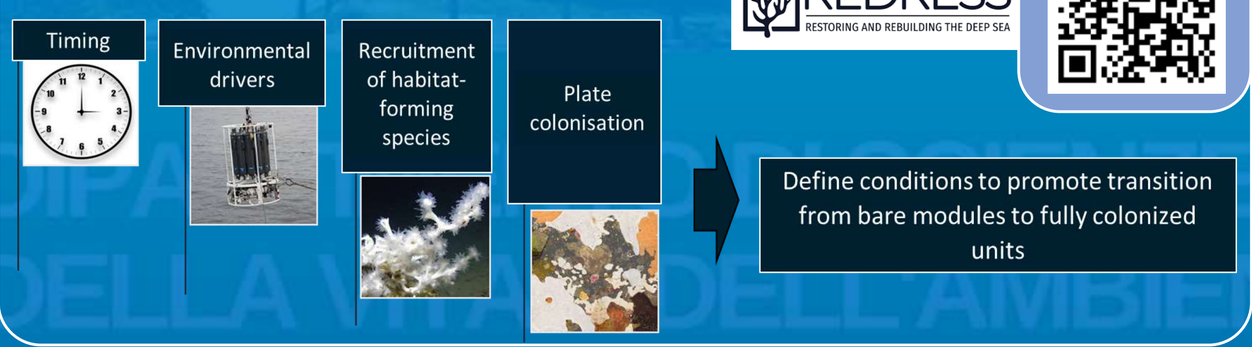
Methods

- **Artificial Structures for Deep-sea species recruitment and Ecosystem Restoration** (**ASDERs**), supporting modified Autonomous Reef Monitoring Structures (ARMS) and equipped with HD cameras, hydrophones, micro-CTDs.

- **Larval attraction devices**, acoustic and bio-light emitters.
- **Restoration area characterisation**: eDNA, meiofauna, organic matter.



Expected results



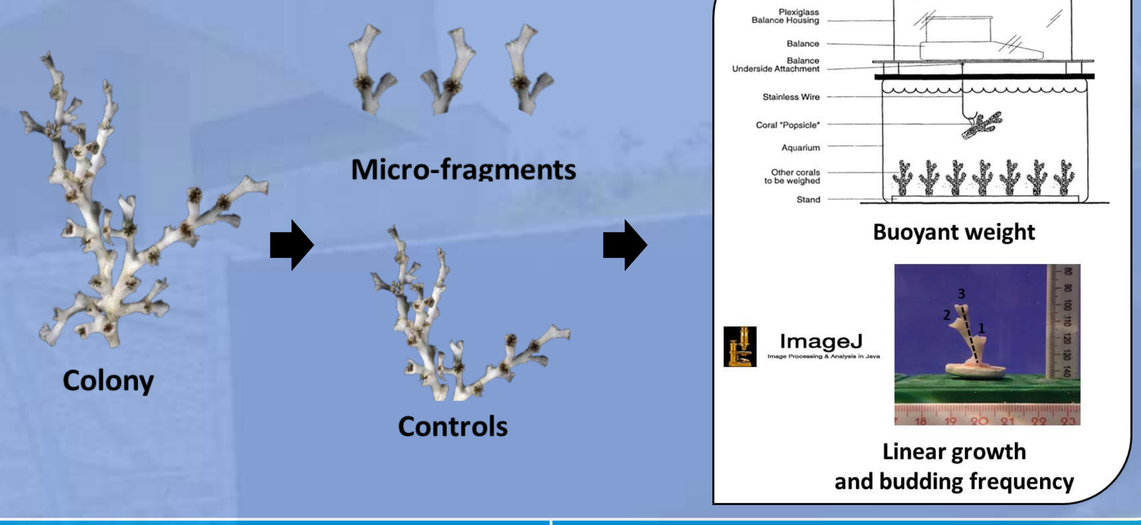
Ex-situ propagation of the Cold-Water Coral *Desmophyllum pertusum*: micro-fragmentation for deep-sea corals

AIM

Set up and development of the **micro-fragmentation** technique to produce new coral colonies

Methods

White coral colonies were recovered from the Dohrn Canyon by means of a remotely operated vehicle (ROV) and maintained in a small-volume experimental system.



Expected results

- Assess the suitability of the micro-fragmentation technique.
- Establish a protocol for optimal fragment size and maintenance.

References:

1. Danovaro, R., Fanelli, E., Aguzzi, J., Billett, D., Carugati, L., Corinaldesi, C., et al. (2020). Ecological variables for developing a global deep-ocean monitoring and conservation strategy. *Nat Ecol Evol* 4, 181–192. doi: 10.1038/s41559-019-1091-z
2. Levin, L. A., and Bris, N. L. (2015). The deep ocean under climate change. *Science (1979)* 350, 766–768. doi: 10.1126/science.aad0126
3. Da Ros, Z., Dell'Anno, A., Morato, T., Sweetman, A. K., Carreiro-Silva, M., Smith, C. J., et al. (2019). The deep sea: The new frontier for ecological restoration. *Mar Policy* 108. doi: 10.1016/j.marpol.2019.103642
4. Chen, W., Wallhead, P., Hynes, S., Groeneveld, R., O'Connor, E., Gambi, C., et al. (2022). Ecosystem service benefits and costs of deep-sea ecosystem restoration. *J Environ Manage* 303. doi: 10.1016/j.jenvman.2021.114127