

How Can Microbes Create a Marine Habitat?



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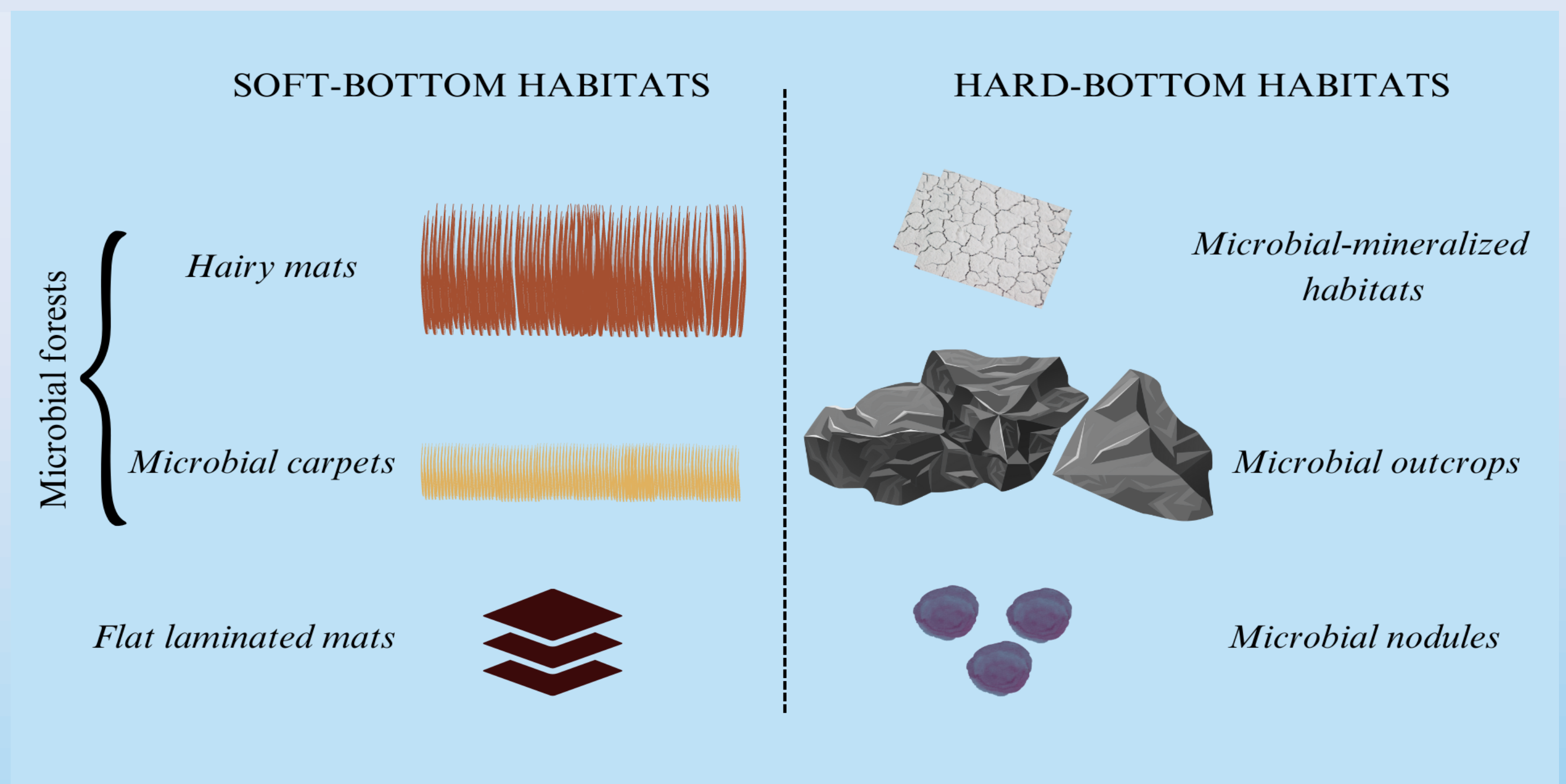
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Introduction & Aims

Microbes (prokaryotes and eukaryotes) greatly influence the biogeochemical cycles of the oceans and the health of larger species. Here, I argued for the importance of marine **microbial habitats**, i.e., habitats created by microorganisms (such as bacteria, archaea and protozoans) [1, 2, 3]. Microbial habitats support **biodiversity**, are common in **extreme environments**, and have several **ecological roles**.

Aims of the study:

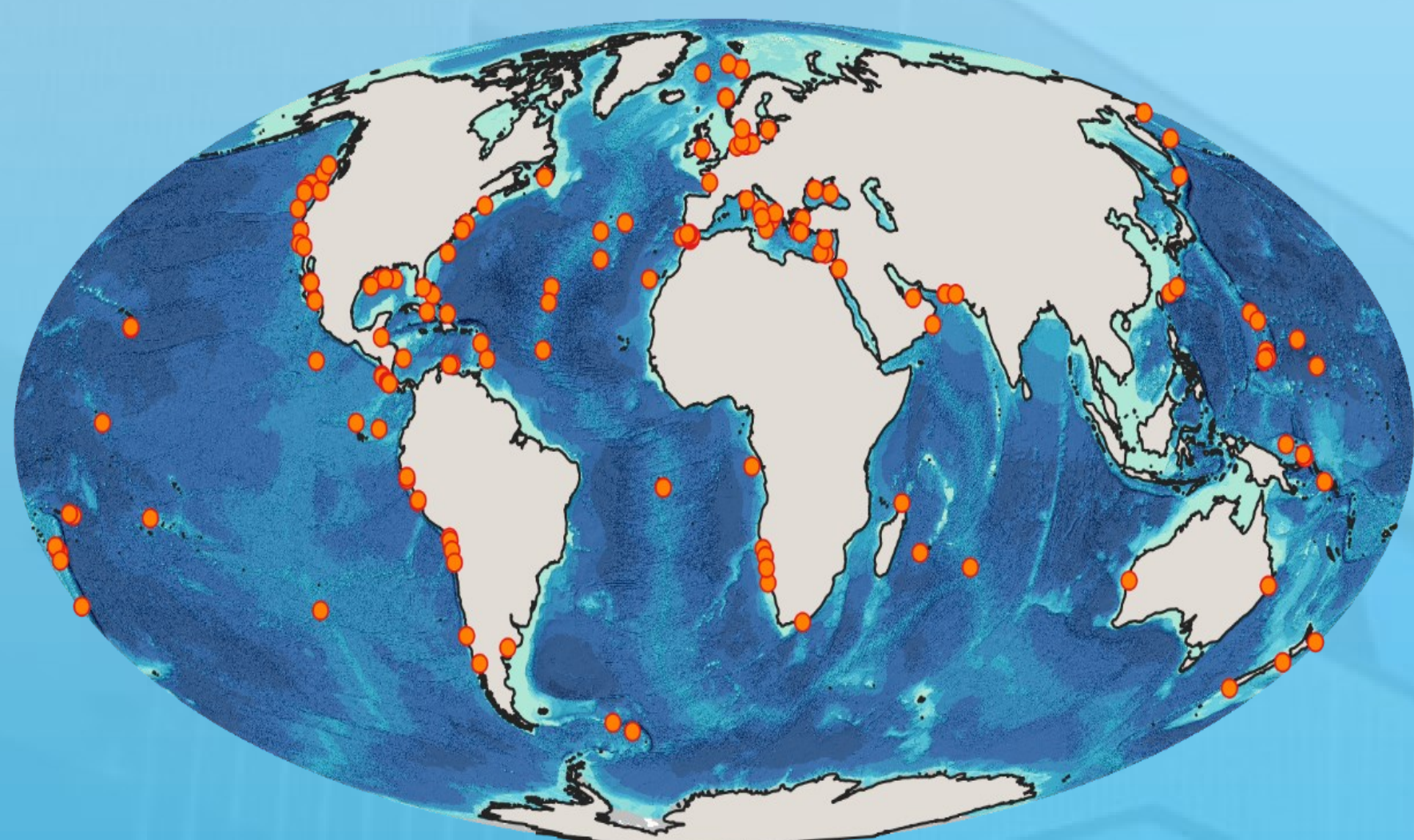
- Investigate the role of microbes in shaping marine habitats.
- Describe the biodiversity associated with microbial habitats and their roles in ecosystem functioning.



Materials & Methods

Microbial habitats macro-scale distribution can be studied through visual observation techniques (SCUBA, ROV) and acoustic mapping. While micro-scale properties can be studied through electron microscopy (SEM or TEM). Traditional taxonomic techniques as well as molecular tools can be applied to study their associated biodiversity and ecosystem roles.

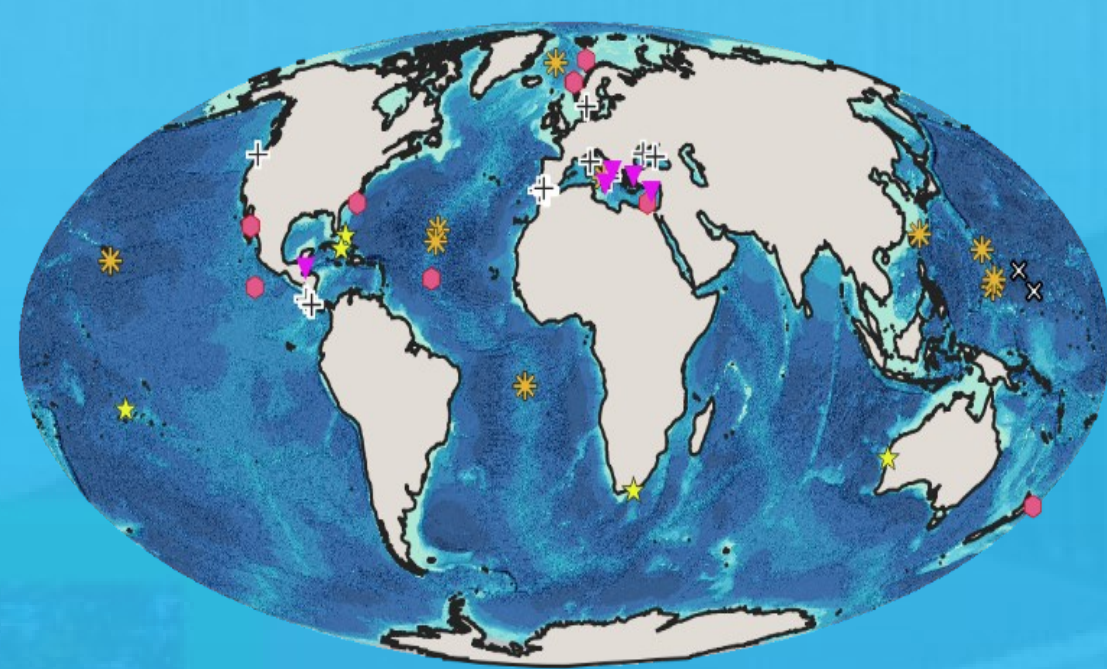
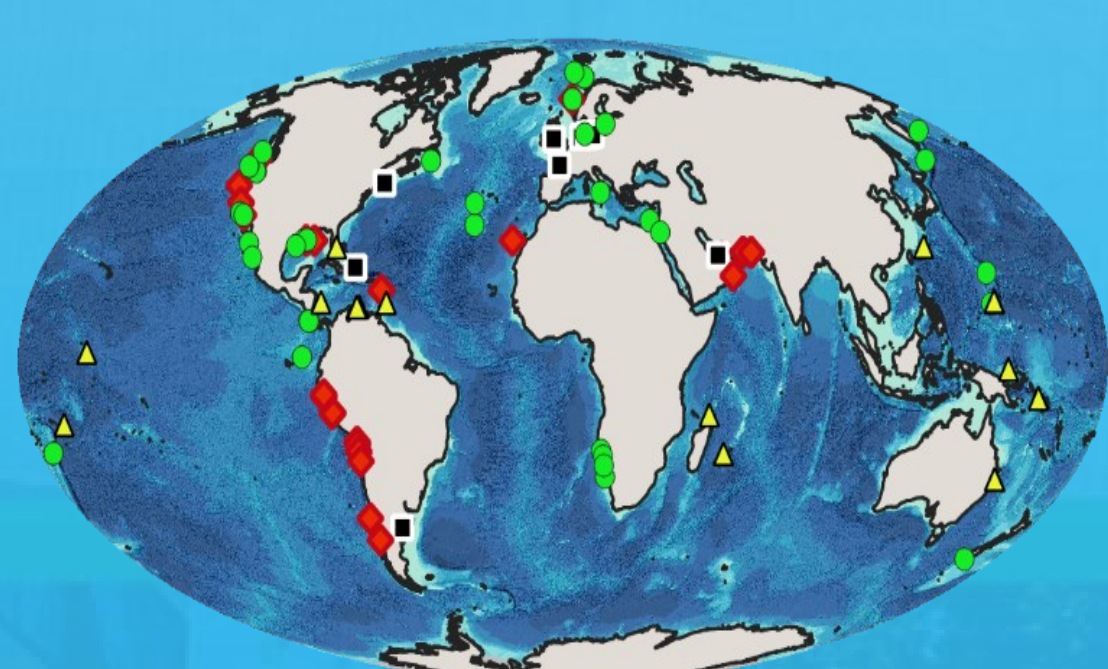
Global Distribution of Microbially-Formed Habitats



Soft-bottom habitats

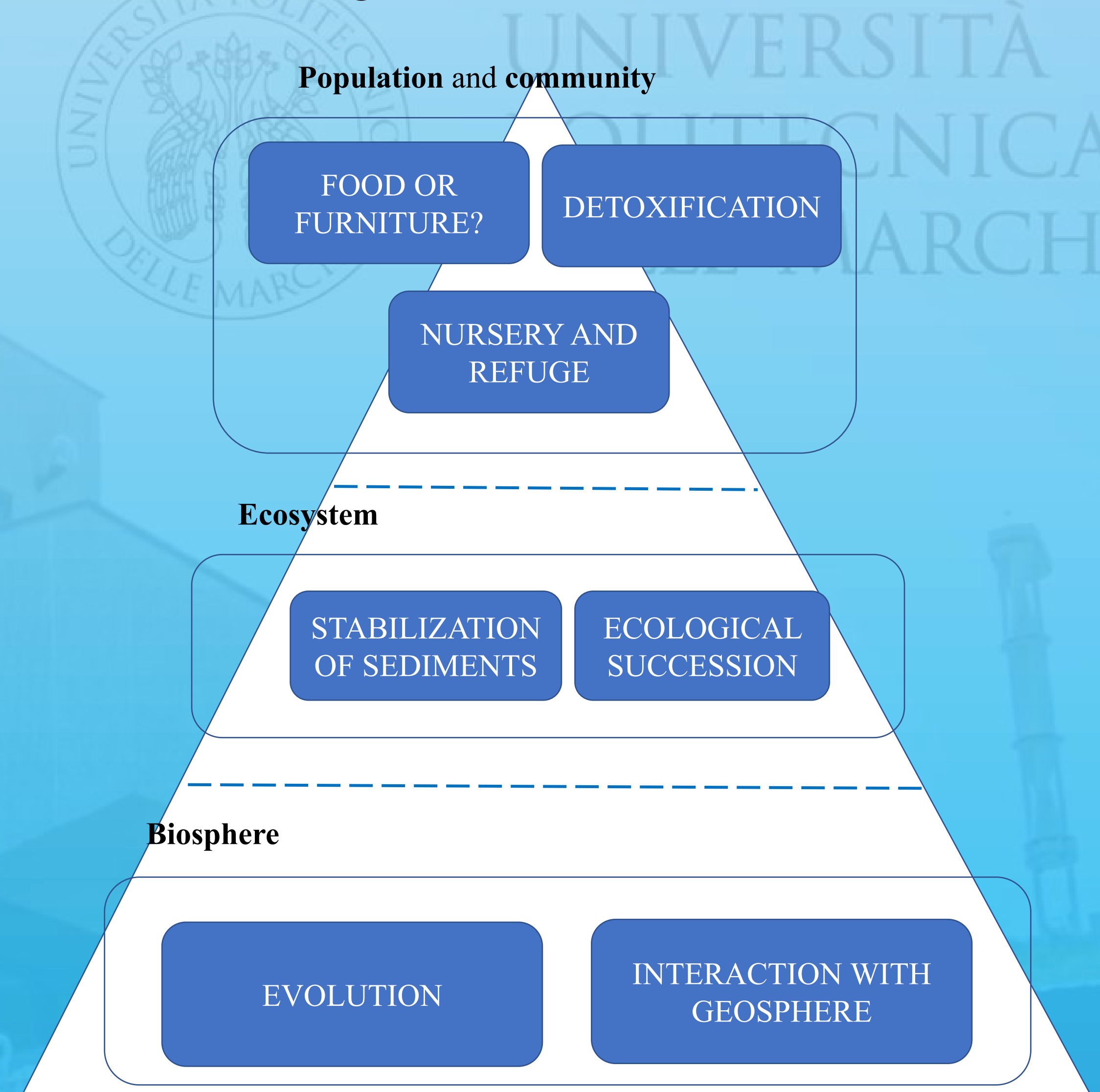
Hard-bottom habitats

- | | | | |
|-----------------------|----------------------|--|-----------------|
| ■ Flat-laminated mats | ● Microbial carpets | ⊕ CH ₄ -derived authigenic carbonates | ★ Microbialites |
| ◆ Hairy mats | ▲ Tropical reef mats | ⊗ Microbial nodules | ● Sulfur mat |
| | | ▼ Biostalactites | ★ Iron mat |



Microbial habitats are present under varying environmental conditions (e.g., from coral reefs to oxygen minimum zones). It is likely that many more microbial habitats will be discovered in the next future thanks to technological advancements and thanks to the ongoing exploration of the oceans.

Ecological Roles of Microbial Habitats



Microbial habitats are colonized by larger organisms using them as **nursery** or **refuge**. Over longer period of time or on larger scales in space, microbial habitat development can start **ecological successions**. Considering geological time scales, microbial habitats influenced the **evolution** of life in our planet.

References

- [1] Danovaro, R., Canals, M., Tangherlini, M., Dell'Anno, A., Gambi, C., Lastras, G., Amblas, D., Sanchez-Vidal, A., Frigola, J., Calafat, A. M., Pedrosa-Pàmies, R., Rivera, J., Rayo, X., & Corinaldesi, C. (2017). A submarine volcanic eruption leads to a novel microbial habitat. *Nature Ecology & Evolution*, 1(6).
- [2] Levin, L. A., Mendoza, G. F., Grupe, B. M., Gonzalez, J. P., Jellison, B., Rouse, G., Thurber, A. R., & Waren, A. (2015). Biodiversity on the Rocks: Macrofauna Inhabiting Authigenic Carbonate at Costa Rica Methane Seeps. *PLOS ONE*, 7.
- [3] Kouris, A., Limén, H., Stevens, C., & Juniper, S. (2010). Blue mats: Faunal composition and food web structure in colonial ciliate (*Folliculinopsis* sp.) mats at Northeast Pacific hydrothermal vents. *Marine Ecology Progress Series*, 412, 93–101.

Acknowledgements

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