

ToC-ToC - SMART - To Change or not To Change: Assessing Sponge-Microbiome Acclimatization to changing environmental conditions through Reciprocal Transplantation

DiSVA, Laboratorio di Ecologia Microbica e Molecolare

Anna Salvatori

Tutor: Prof. Antonio Dell'Anno

Background

Porifera represents one of the most successful and functionally relevant taxa colonizing the sea bottoms. Such capacity has been partially attributed to the intimate partnerships with microorganisms that enlarge their metabolic arsenal, providing photosynthates, DOM re-cycling products, UV-protectants and chemical defenses.

Target species

Three sponge species commonly inhabiting Mediterranean hard bottom substrates were selected based on the feasibility for transplants and trophic strategy:

Petrosia ficiformis

Chondrosia reniformis

Chondrilla nucula



Study areas

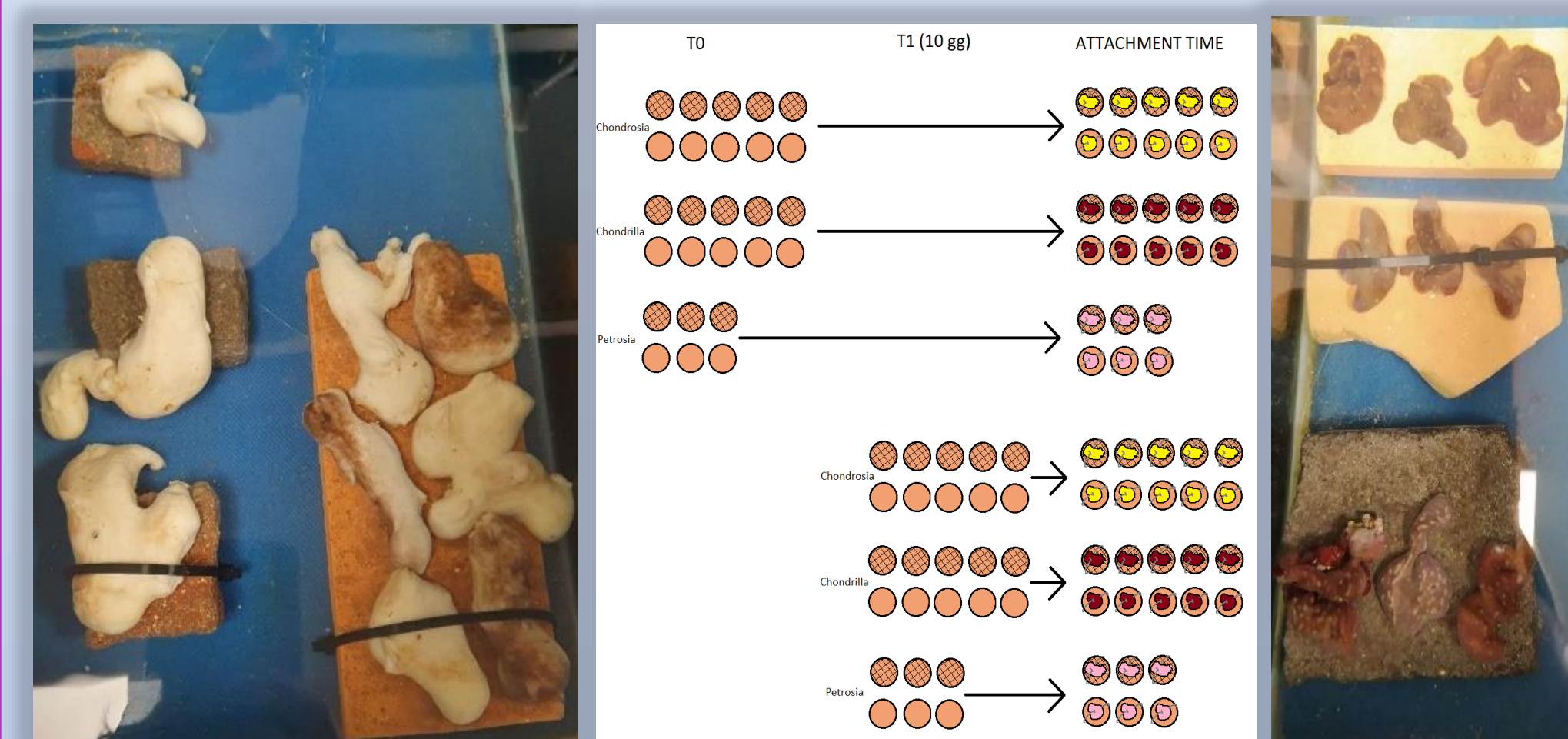
Two study sites and corresponding controls have been selected to assess acclimatization to two paired environmental conditions:

- Acclimatization to OA vs ambient pH – Site Grotta del Mago (Ischia Island, Naples), average pH of ~7.6; control: rocky cave with average pH of ~8.1.
- Acclimatization to light vs dark – Site Grotta Punta Vico (Ischia Island, Naples), a semi-submerged rocky cave; control: the illuminated area near the entrance of the cave.

Aim of the PhD project

To acquire a holistic comprehension of the sponge as an holobiont system, linking hosts ecological traits with microbiome dynamics in order to better understand the acclimatization potential of Porifera towards changing environmental conditions.

How to do the transplants? Results from the first year

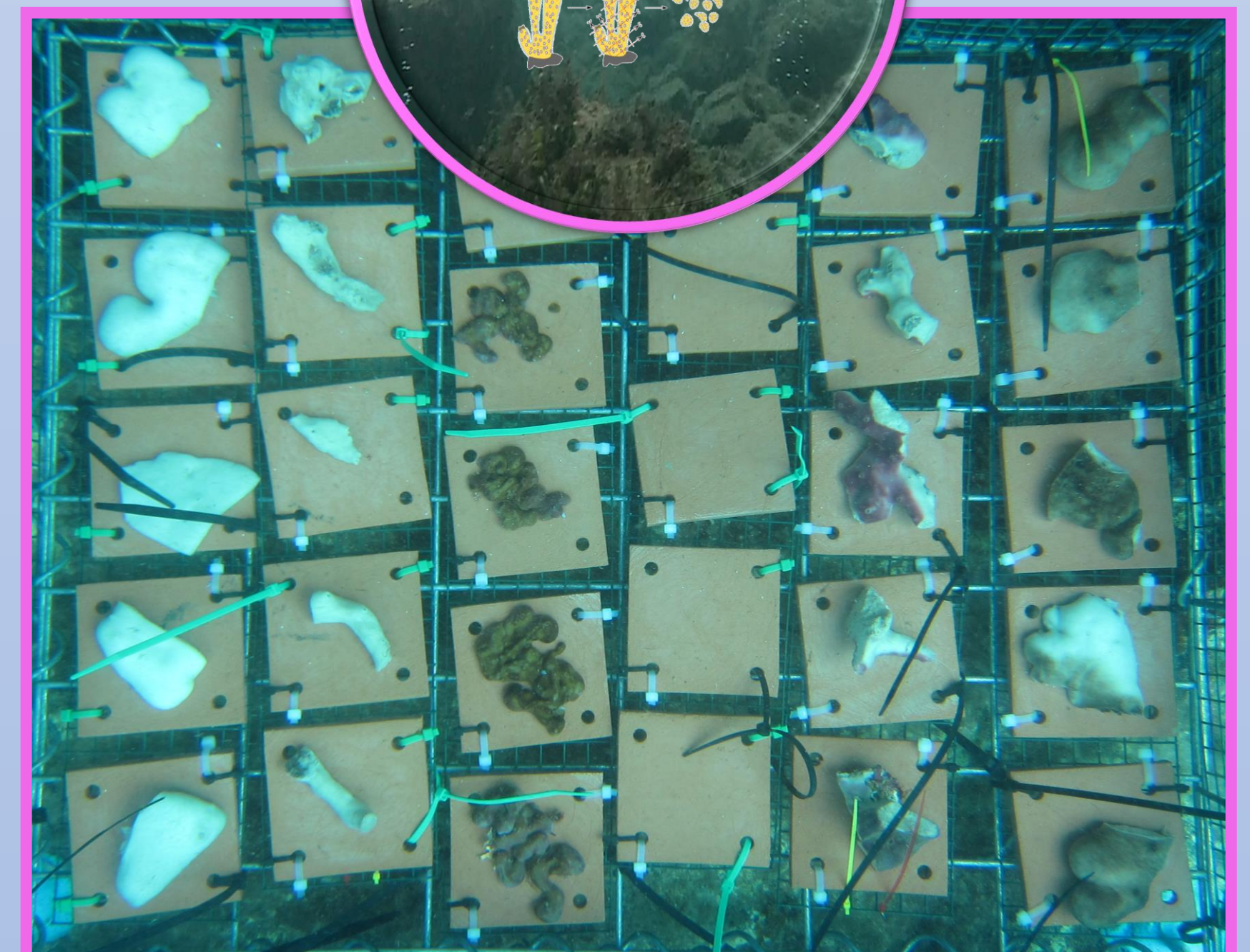
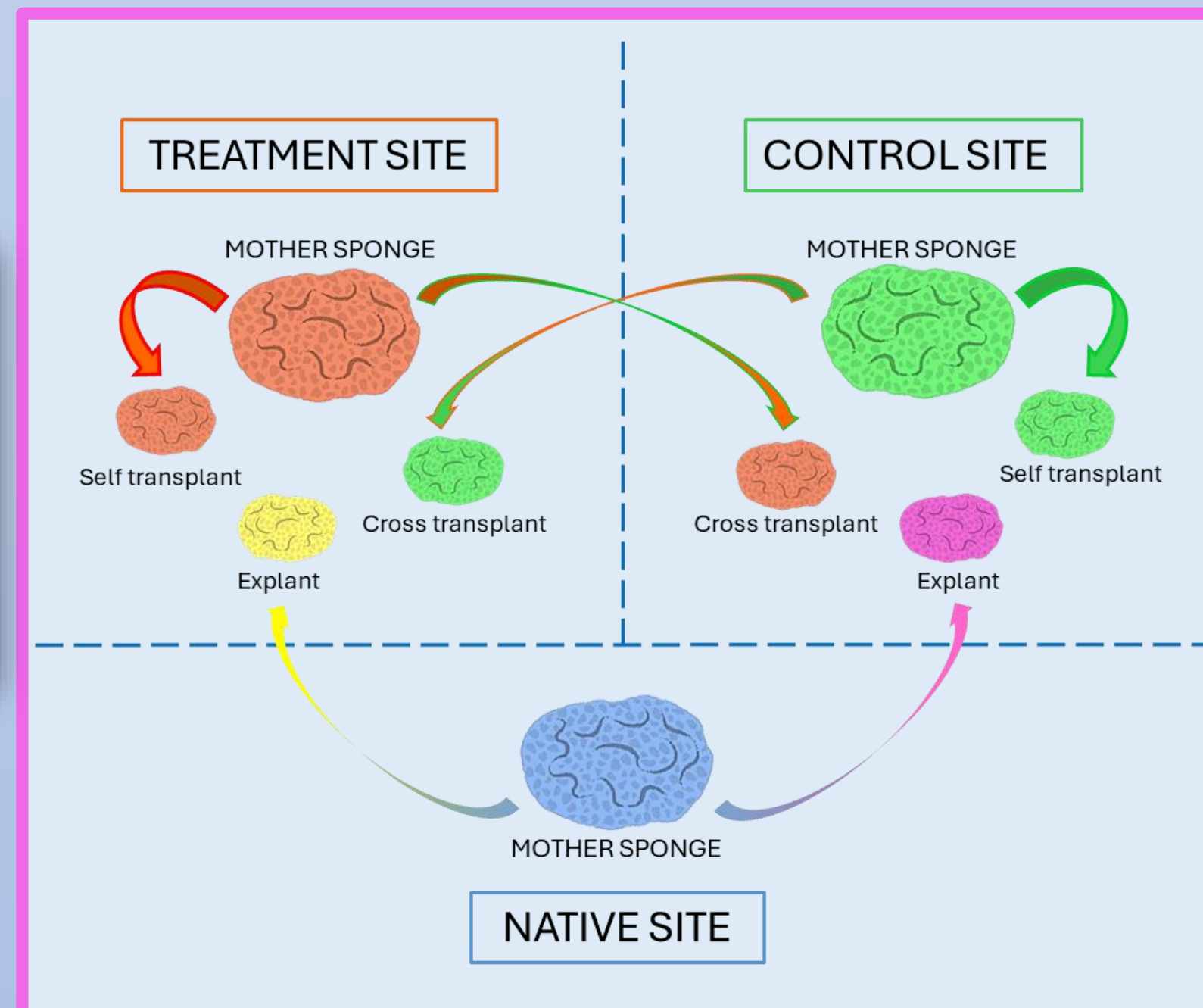
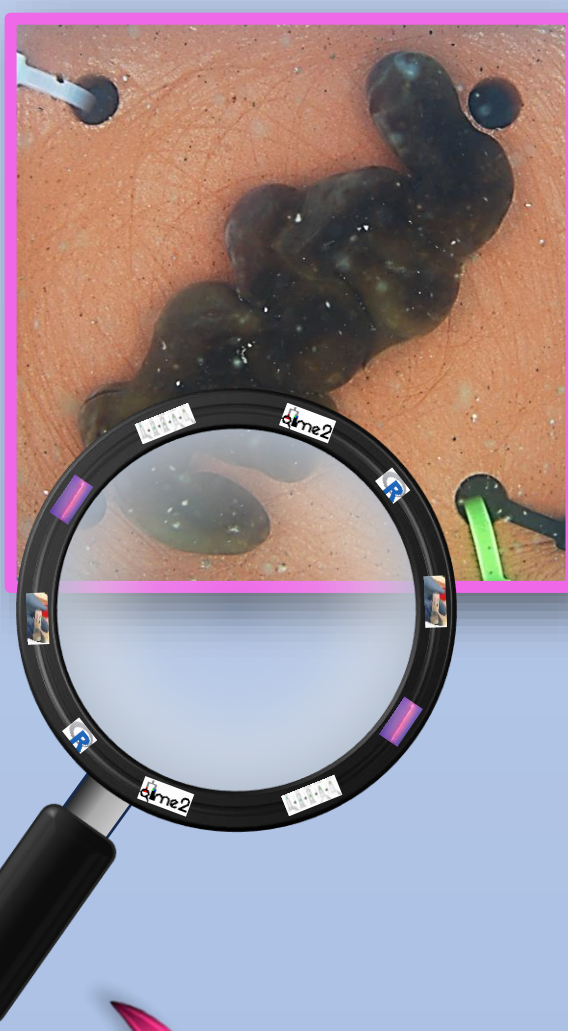


- Clonal grafts are possible
- The fishing line is the right compromise to secure the sponge to the substrate
- Raw clay tile with rough surface, not subjected to industrial treatments is a good substrate

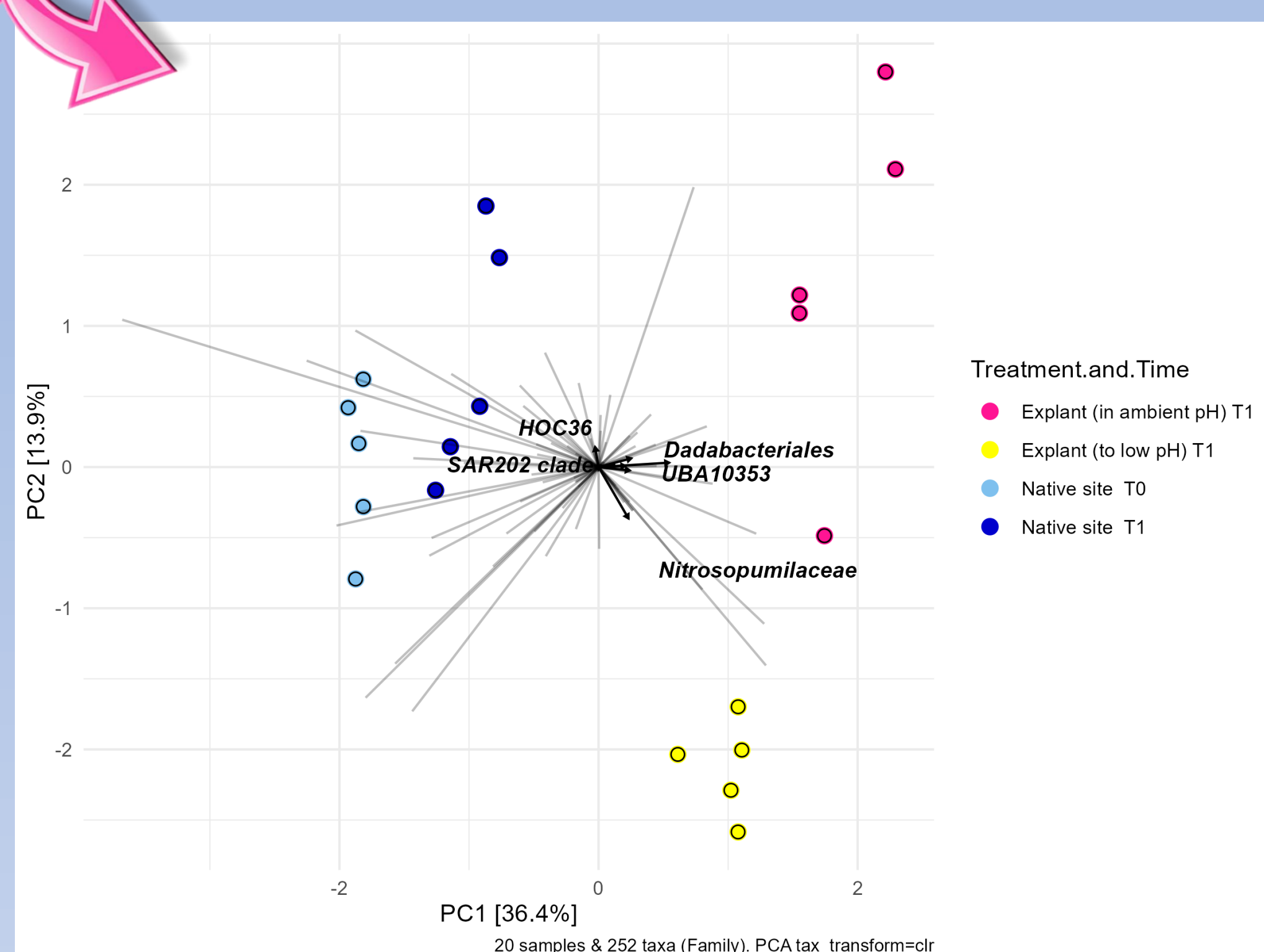
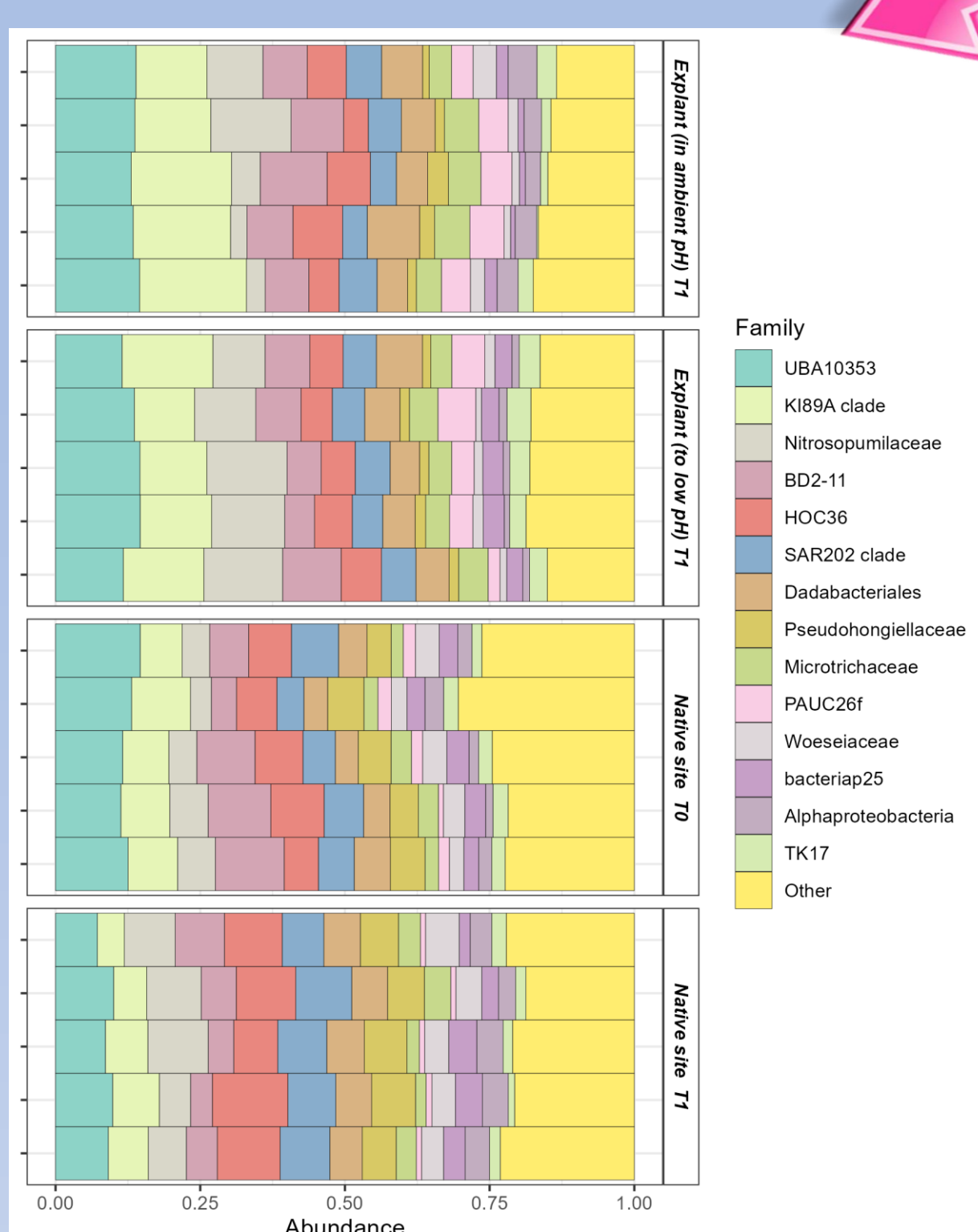


Field work: transplantation activity

In both the experimental conditions, for *P.ficiformis* and *C.reniformis*, reciprocal transplantation was carried out. Explants of *C.nucula* were instead transplanted from their native site to the different sites. After 2.5 months, transplants and wild individuals were collected for high throughput sequencing of the prokaryotic 16S rRNA gene.



Preliminary results for *Chondrilla nucula* in OA experiment



Compositionally, the majority of taxonomic changes between wild sponges and transplants is only due to fluctuations in relative abundance and not losses or gains of groups (except for some rare taxa). The transplants in the two conditions display differences in beta diversity; this could be evidence of the acclimatization of the holobiont to the different environment.

References

- 1) Bell JJ, Rovellini A, Davy SK, Taylor MW, Fulton EA, Dunn MR, et al. (2018). Climate change alterations to ecosystem dominance: how might sponge-dominated reefs function? Ecology 99, 1920–1931. doi: 10.1002/ecy.2446. 2) Thomas, T., Moitinho-Silva, L., Lurgi, M., Björk, J. R., Easson, C., Astudillo-García, C., et al. (2016). Diversity, structure and convergent evolution of the global sponge microbiome. Nat. Commun. 7, 1–12. doi: 10.1038/ncomms11870. 3) Freeman CJ, Easson CG, Fiore CL and Thacker RW (2021) Sponge-Microbe Interactions on Coral Reefs: Multiple Evolutionary Solutions to a Complex Environment. Front. Mar. Sci. 8:705053. doi: 10.3389/fmars.2021.705053