# Impact of heavy metal and nutrient pollution on the microbiota of temperate corals from the Mediterranean Sea

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## Introduction

- Gorgonians are key habitat-forming species of temperate benthic communities[1].
- Dramatic population declines due to local human impacts and mass mortality events caused by high temperatures and disease outbreaks[2].

*Recently, we have shown*[3,4,5]*:*

- Ancient host-microbe associations conserved through evolutionary times.
- Divergence in microbiome composition clear along distant phylogenetic lines.
- Highly structured and relatively stable gorgonian-associated bacterial communities on both temporal and seasonal scales
- Unique composition of *Corallium rubrum* microbiota
- Microbiome impacted by / acclimated to local environmental conditions.

***OBJECTIVES –*** Understand functional differences in the microbiota of gorgonians and how it is impacted by the most common pollutants in the Mediterranean Sea: copper and nutrients.


**Figure 1** - Composition of the bacterial communities associated with five different gorgonians over time at two different locations – Cassis and La Spezia.

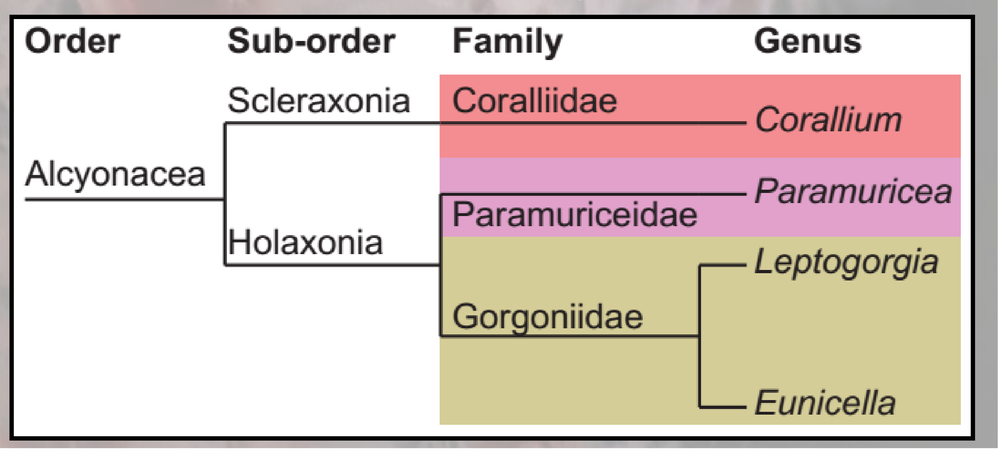



**Figure 2** - Schematic overview of Mediterranean gorgonian taxonomy. The different colours identify taxa harbouring distinct core microbiomes.

## Material & Methods

**Study species (encompassing 3 families, 2 sub-orders)**

*Eunicella cavolini*
*Paramuricea clavata*
*Corallium rubrum*

**Experimentally exposed to copper pollution and eutrophication for 18 hours (n=6 per condition)**

**Metatranscriptomics analysis**

Library preparation – rRNA and polyA mRNA-depleted
Sequencing on Illumina HiSeq4000
Data analysis: SAMSA2 pipeline[6] and DESeq2[7]

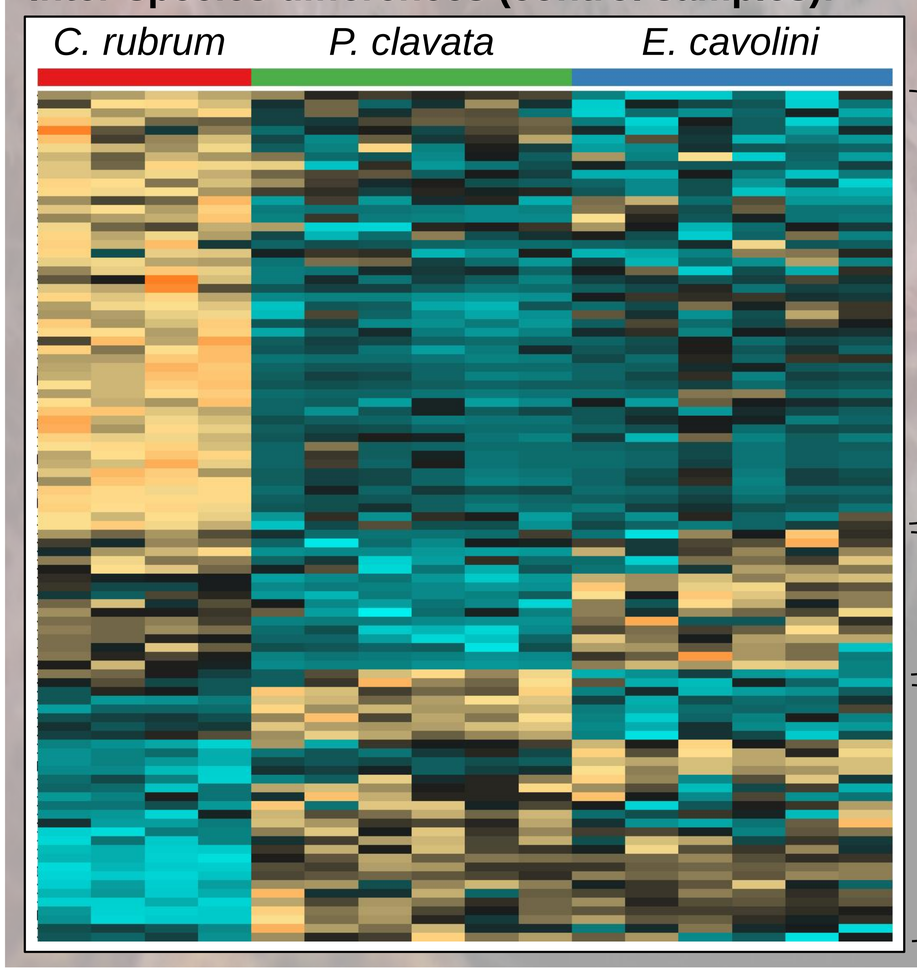
## Discussion & Conclusions

1. Eutrophication has no effect on the microbiota of temperate gorgonians
2. Bacteria limit toxicity of copper by upregulation of heavy metal transporters
3. Copper may affect host health due to increased bacterial virulence and inactivation of phages[8]
   → Long term effect microbiota composition?
4. Major functional differences in the microbiota of sympatric gorgonian species
   → *C. rubrum* : protection against bacteria and phages, amino acid production, iron uptake.

## Results

**Eutrophication:** No short-term effect
**Copper pollution**: No effect on *C. rubrum* microbiota
Effect on microbiota of *P. clavata* and *E. cavolini* is similar
> upregulation copper and heavy metal transporters, and chaperone DnaK
> increased virulence and reduced phage-related processes

**Inter-species differences (control samples):**

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**Acknowledgements**

- *Eric Tambutté* - background photo ©
- Funding provided by Fondation Paul Hamel & KAUST