Dottorato Nazionale in Scienze Polari - Università Ca' Foscari Venezia - Ciclo XL

Microbiome of Antarctic benthic invertebrates and its role in adaptation to freezing conditions

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INTRODUCTION

Antarctica is an ice-covered continent surrounded by the Southern Ocean with peculiar and extreme conditions. Marine metazoans living in polar ecosystems have developed adaptations such as the slow-down in growth rate and increase in oxygen consumption to maintain homeostasis (Peck, 2018). There is evidence that all multicellular organisms in the oceans live in close relationship with their microbiomes, which provide the hosts with strategic functionalities (e.g. nutrient supply, development and defence) and become an integral component of the host physiology (Pollock et al.2018; Appril 2020; Maragon et al.2021). Recently, a study conducted on three species of polychaetes demonstrated that these invertebrates produce cryoprotective proteins and that their microbiome concurs to protect them from extreme cold (Buschi et al. 2024). This lead to hypothesize a functional role of the microbiome in metabolizing nutrients and in the adaptation to the hostile conditions of Antarctica. Further research is needed to broaden knowledge on the functional role of the microbiomes of Antarctic marine organisms and their ability to foster the hosts to cope with the extreme Antarctic conditions.

OBJECTIVES

To study the diversity of microbiomes in different species of benthic invertebrates belonging to different trophic levels

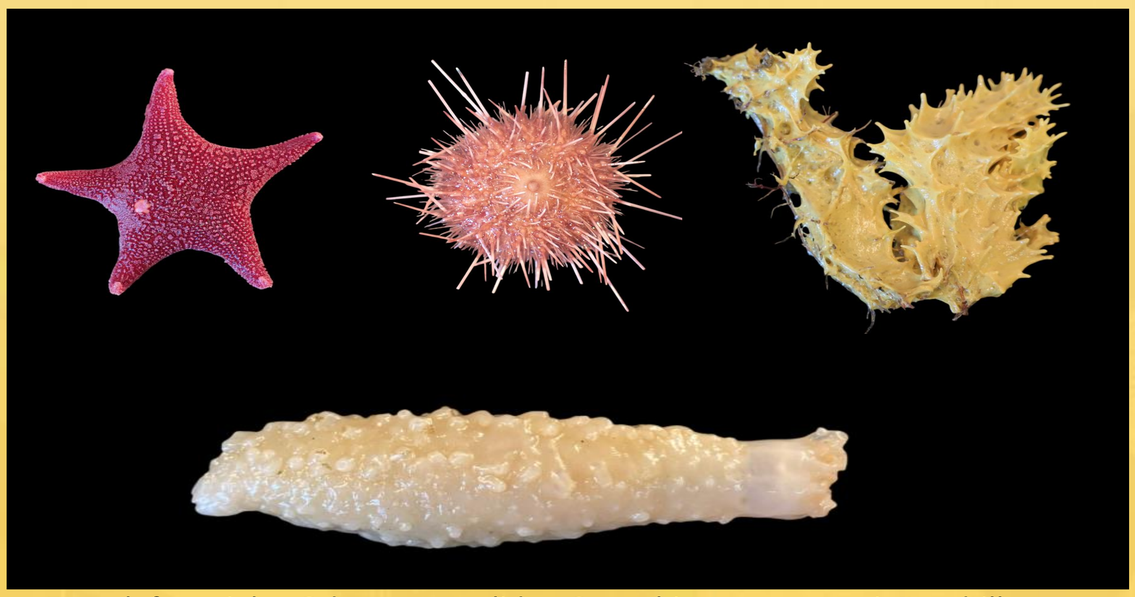
To discover the functional microbial roles that provide the hosts with abilities and properties to survive extreme conditions

To identify specific cellular components with cryoprotective functions that enable life under extreme conditions

PROPOSED METHODOLOGIES

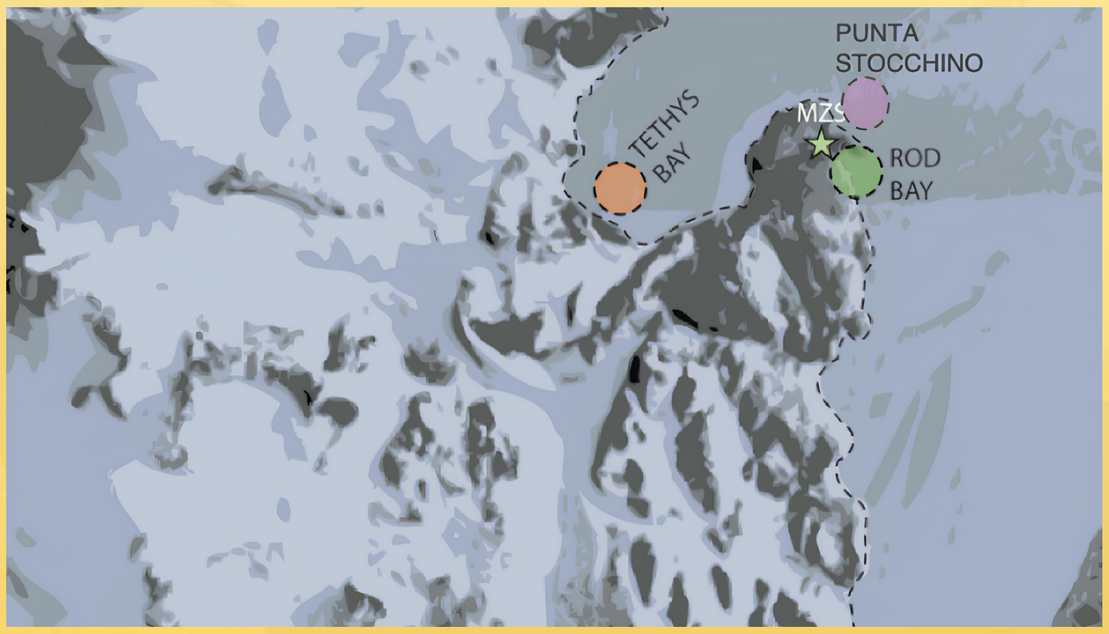
Target species

Distinct species of benthic invertebrates belonging to different trophic levels were collected during the XL Italian Expedition to Antarctica: n=25 Asteroidea; n=25 Echinoidea; n=5 Holothuroidea; n=5 Porifera



From left to right: *Odontaster validus, Sterechinus neumayeri, Dendrilla sp.*; Below: holothurian belonging to the Phylloporidae or Cucumariidae family)

Study area: Terra Nova Bay, Antarctica (Punta Stocchino, Tethys Bay and Rod Bay)



Laboratory analyses: genetic characterization of the invertebrates, metabarcoding, metagenomics and proteomics

EXPECTED RESULTS

To expand knowledge on microbiomes of Antarctic benthic organisms

To determine whether different invertebrates can acquire specific abilities from their microbiomes

To discover potential differences in terms of microbiomes composition according to different trophic strategies

To assess if there are adaptations specific to certain groups of organisms or if they are widespread among all invertebrates

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