

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

## **Effects of climate change on the** phenology of benthic marine organisms in temperate waters Veronica Marchesi

## DiSVA, Laboratorio di Zoologia marina

Tutor: Cristina Gioia Di Camillo

**Issue:** Ocean warming is imposing increasing stress on marine ecosystems, exposing species to extreme temperatures that may exceed their thermal tolerance limits. This can affect the phenology, physiology and ecological interactions of key species, leading to shifts in their distributions, and altering community structure and dynamics<sup>1</sup>. The initial synchrony within ecosystems may be disrupted and, in some cases, environmental disturbances can lead to desynchronization<sup>2</sup>.

**Objective:** To study the phenology of Mediterranean benthic organisms, which can provide valuable insights into how benthic communities respond to climatic anomalies.



**WP1**: The relationship Cnidaria-Symbiodiniaceae as sentinel of climate change

Gaps/Objectives



#### State of the art

The rise on temperatures, UV and high solar irradiance are threatening the symbiosis between corals and zooxanthellae<sup>3</sup>.

Increased host mortality

events through bleaching

#### Bleaching among tropical anthozoans is well studied.

 $\rightarrow$  limited data available on **temperate** anthozoans

Reef-building corals are known to be very vulnerable to climate change.  $\rightarrow$  little is known about the resilience of non-reef-building species, and especially of soft corals

#### Experiment

Anemonia viridis (Forsskål, 1775)



Analysis of the dynamics between host and symbiont under different environmental conditions, in controlled systems.



#### Possible outputs

Deliverable: 1 pubblication; 1 conference attendance; 1 divulgative event

Outcomes: obtaining a benchmark to study potential dysbiosis and to do comparison with other symbiotic species

WP2: Evaluating the resilience and short-term replacement of Marine Animal Forest (long-lived species)

### State of the art

The frequency of marine heatwaves (MHWs) and mucilage events has strongly increased, causing mass mortality events (MME) of many sessile benthic species <sup>4</sup>.



Life-history traits of octocorals make them vulnerable to climate change

## Gaps/Objectives

Fertility and fecundity of coral populations may decline over time.  $\rightarrow$  Obtaining information on the reproductive traits is crucial

Changes in their communities may severely undermine system resilience → Understanding the early stages of the coralligenous recovery

### Experiment

Evaluation of the forests density and assessment of the natural recovery of benthic assemblages affected by MHWs.



Paramuricea clavata (Risso, 1827)



Possible outputs

Outcomes: obtaining data on the status of marine animal forest; providing informations on the early stages of the coralligenous recovery

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aboratory

Marine

Zoology



#### PHD Development Plan



#### References

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- <sup>2</sup> Vagnon, C., Olden, J. D., Boulêtreau, S., Bruel, R., Chevalier, M., Garcia, F., ... & Cucherousset, J. (2024). Ecosystem synchrony: an emerging property to elucidate ecosystem responses to global change. Trends in
- <sup>3</sup> Lopes, A. R., Faleiro, F., Rosa, I. C., Pimentel, M. S., Trubenbach, K., Repolho, T., ... & Rosa, R. (2018). Physiological resilience of a temperate soft coral to ocean warming and acidification. Cell Stress and
- <sup>4</sup> Orenes-Salazar, V., Navarro-Martínez, P. C., Ruíz, J. M., & García-Charton, J. A. (2023). Recurrent marine heatwaves threaten the resilience and viability of a key Mediterranean octocoral species. Aquatic Conservation:
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