



The evolutionary challenge of global change: diversity, adaptation and phenology in Mediterranean marine organisms

Pratlong Marine

IMBE – Team Interaction, Diversity, Evolution & Adaptation
I2M – Team Biological Evolution and Modelisation



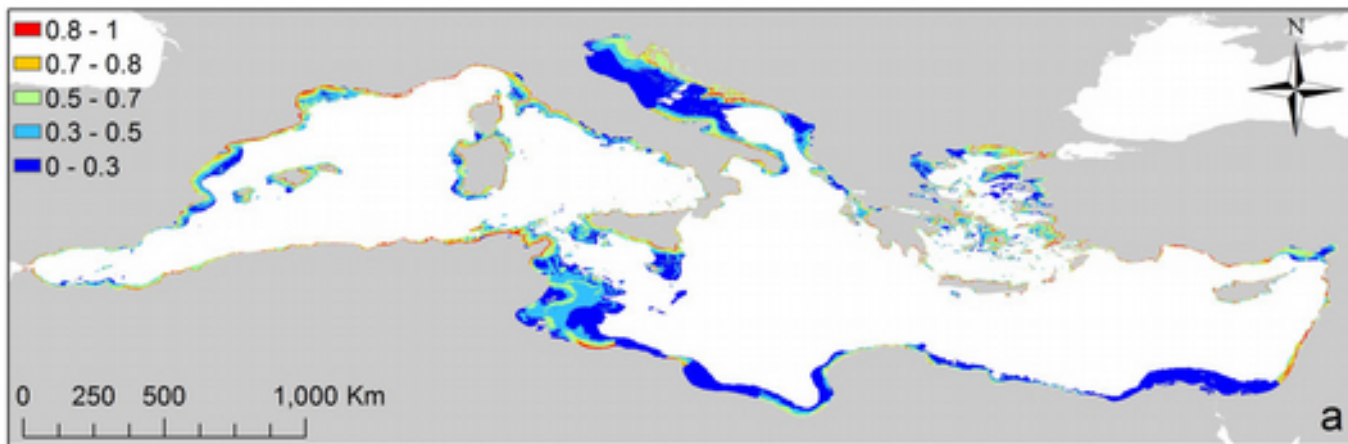


WP2 An evolutionary approach

Three projects, one goal

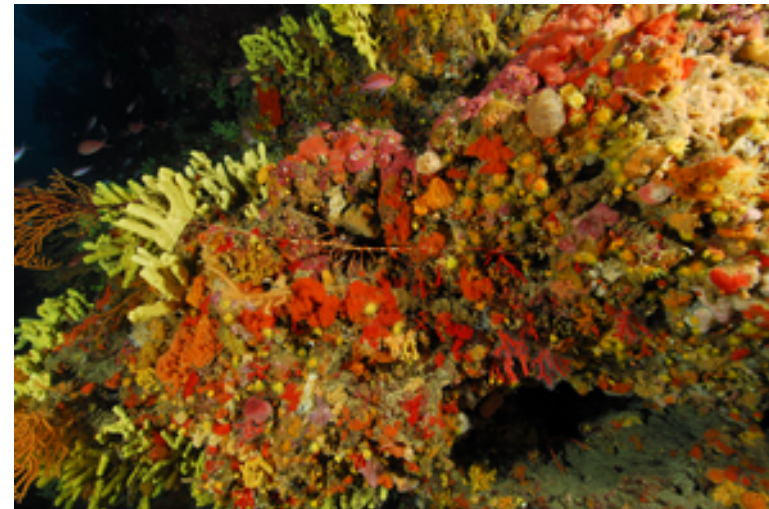
The understanding of the **coralligenous biocenosis**

→ **Emblematic** from the Mediterranean Sea



The coralligenous biocenosis

Definition: Hard substrate of biogenic origin that is mainly produced by the accumulation of calcareous encrusting algae.



Biological importance

- **Hot-spots** of biodiversity in the Mediterranean Sea → **1700 species**
- **Carbon sinks** in the Mediterranean Sea

The coralligenous biocenosis

Economical and social importance

- Harvesting of the red coral since 5 000 years
→ Today a multi-million dollars industry

ex: Torre Del Greco, Italia → **\$200 millions** per year



- Habitat and reproduction site for several species with **high commercial value** for fishing
- High economical value for its **attractivity** to recreative diving
→ the most preferred diving spot in the Mediterranean Sea

The coralligenous biocenosis

Threats

- Harvesting and fishing
- Eroding effects: diving, anchoring and fishing nets
- Pollution
- Acidification
- Invasive species
- Climate change



J.G Harmelin



Oceana in Europe / Flickr



Evolution of the coralligenous biocenosis in the context of the global change ?

We need to know:

- The **actual state** and **functioning** of this ecosystem
- The **impact of temperature** on the populations



Project 1

Understanding **ecological functioning** of coralligenous habitats,
and building **new indicators** based on **genetic tools** to assess
their **GES** (good environmental status)

Aurélien De Jode

OT-Med first year PhD

Aim: Creation of indices to **monitor the environmental status**

→ Evaluation of **connectivity** patterns among localities and
ecological profiles (integration of marine currents informations)



Project 1

→ Estimation of the **biodiversity** of coralligenous biocenosis

Specific diversity

Genetic diversity of two builders

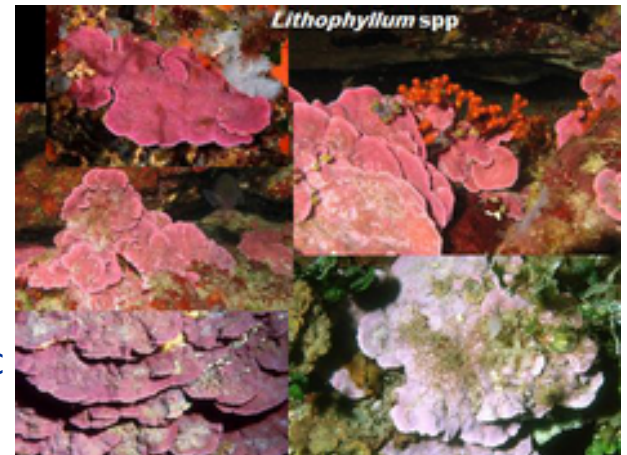


Frédéric Zuberer



Myriapora truncata

Lithophyllum spp.



Frédéric Zuberer



Project 2

Contribution of phenology to study the **impact** of **climate change** on coastal environment: the octocorals as model species

Alexander Ereskovsky

Phenology: study of periodic life cycle events and how there are influenced by **variations in climate** and **habitats factors**



Frédéric Zuberer



Frédéric Zuberer



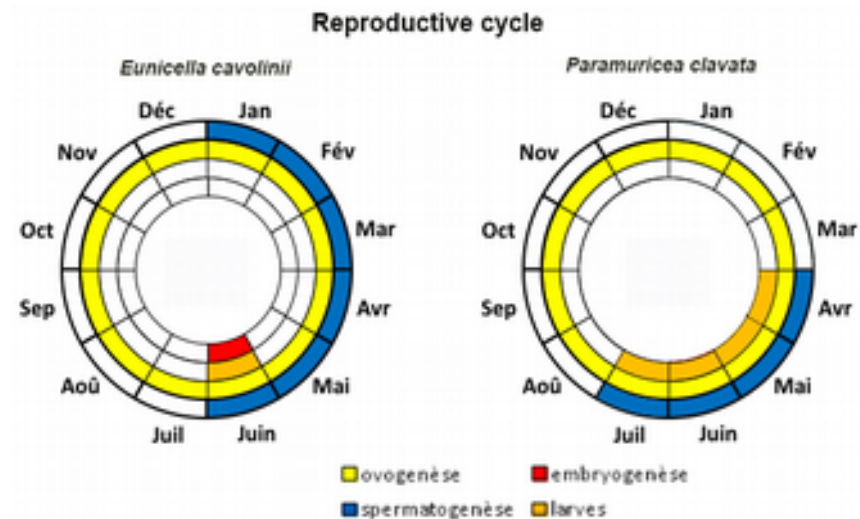
Project 2

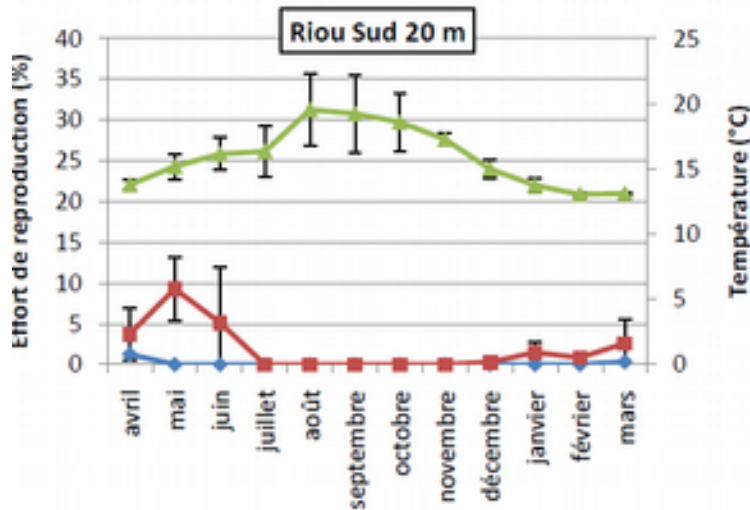
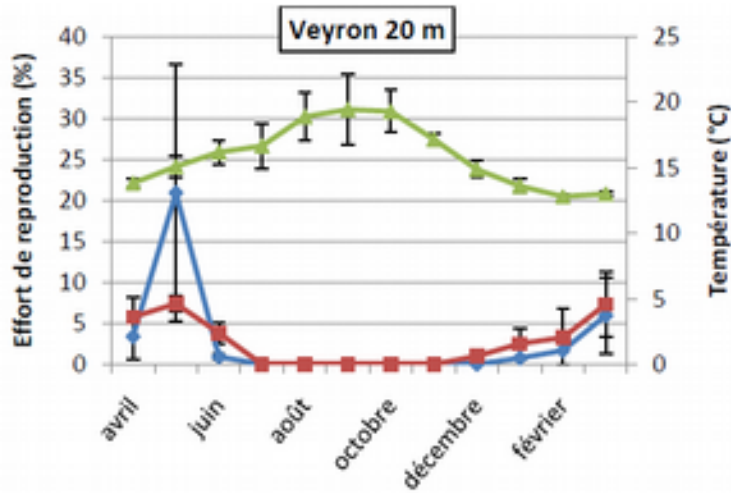
Aim: **Monitor** the phenology of **emblematic Mediterranean species** to better understand the **dynamics** of these populations and their **potential response to climate change**

Alexander Ereskovsky

→ Test the impact of temperature on:

- Reproductive cycle
- Fecundity
- Reproductive effort





- Pilot study
- Differences of reproductive effort depending on site and temperatures

Now:

- Several years
- Link with stress levels (gene expressions)
 - Study of the impact of environmental fluctuations on the stress level: **genetic studies**



A*Midex
Initiative d'excellence Aix-Marseille
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Project 3

The evolutionary challenge of climate change: adaptive processes in the Mediterranean red coral

Marine Pratlong

Ot-Med second year PhD

ADACNI ANR

Context:

- **Mass mortality events** linked to thermal anomalies
- Individuals from shallow water more **thermotolerant** than individuals from deeper habitats



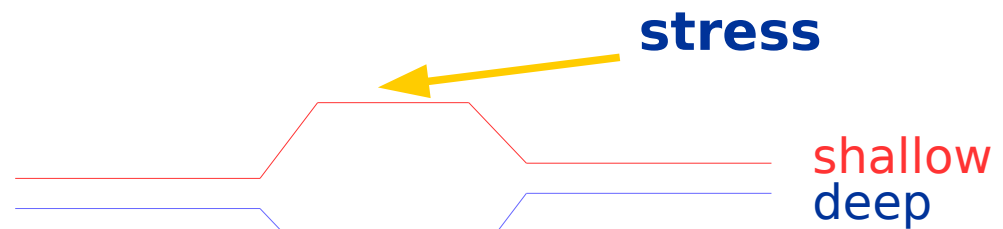


Project 3

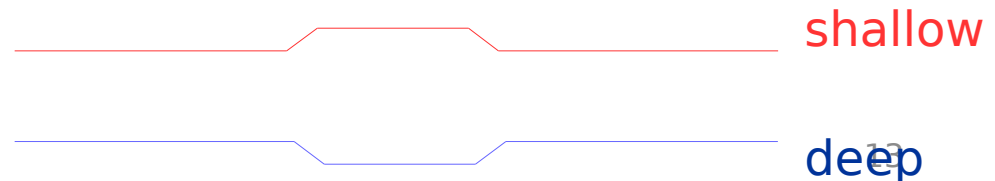
Aim: Understand the **thermotolerance differences** between shallow and deep populations to assess their **survival abilities** in the context of climate change.

→ Are the differences linked with temperature between shallow and deep populations:

restricted to stress periods



or **persistent?**





Project 3

Genes related to **cell survival** & **pathogen interaction**

over-expressed in shallow individuals in winter

Documented for the **adaptation** to high temperatures variations for tropical corals

Existence of a genetic background of the thermotolerance?

→ Implications for the management of populations

→ Evaluation of populations reactions to future environmental variations



Conclusion

Collaborations for the understanding of coralligenous biocenosis:

PhD on the socio-economic study of the coralligenous	IMBE/GRECAM
ADACNI ANR → modelisation of the evolutionary response of some species	MIO
Study of the physical connectivity	MIO

Ecosystem services





The coralligenous biocenosis



Thanks to CIGESMED divers