Bridging the gap between evolutionary and conservation biology: the case of a precious octocoral threatened by global change, the Mediterranean red coral

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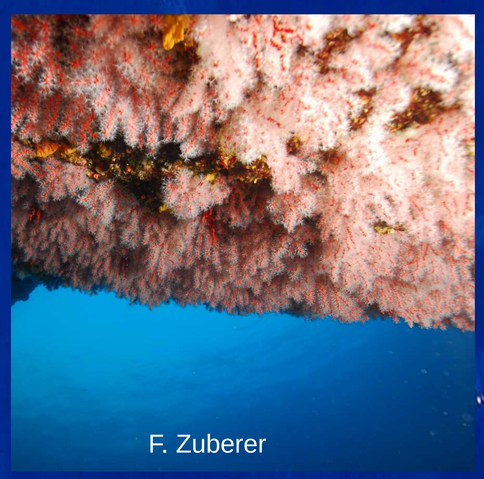
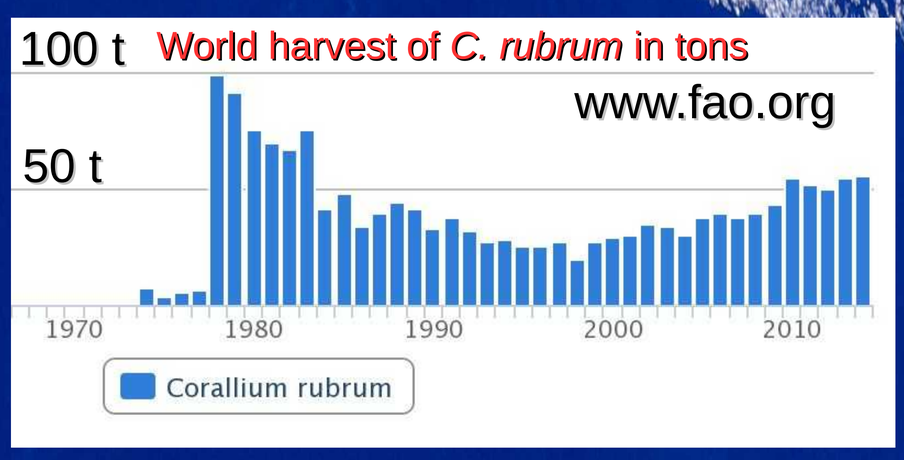


The red coral , *Corallium rubrum*

Mediterranean and Atlantic octocoral
Range depth 10 - 1000 m
Long-lived species (> 100a) / low dynamics

Harvested species (jewellery)
↓ size structure (Garrabou et al., 2017)



Marine heat waves → mortality events
Differences according to depth

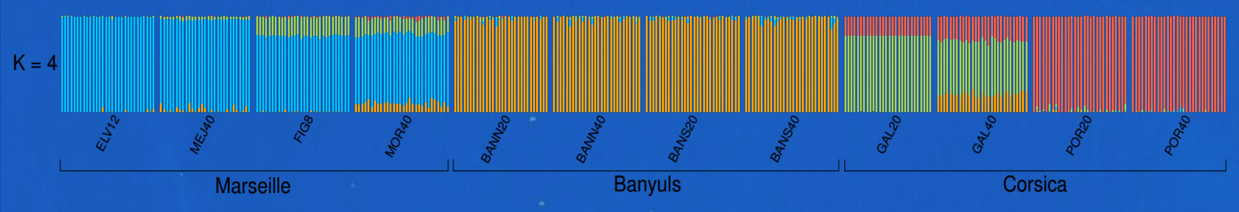
Red coral colony with partial necrosis and overgrowth by epibionts

Future evolution ? Shrinkage of range depth ? (Galli et al., 2017)

Neutral eco-evolutionary dynamics

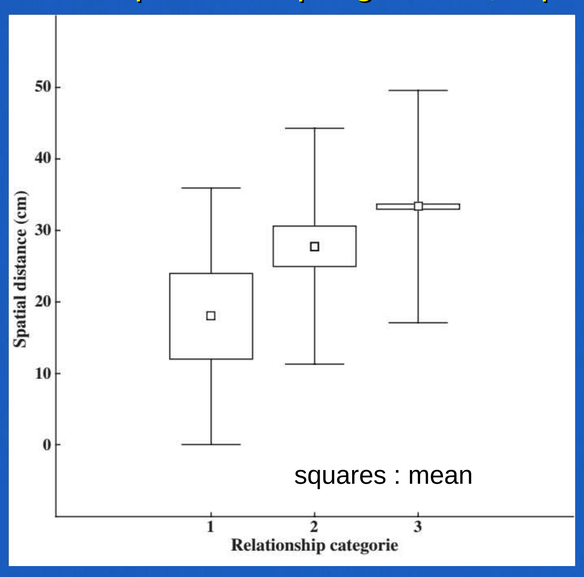
Late maturity (6-10 a)
Irregular recruitment ; rare asexual propagation

Significant genetic differentiation at ≈10s m (microsatellites)
→ low connectivity
Bayesian clustering RAD-Seq : geographical structure + differences between depths, depending on region



Local genetic structure : sampling area 70 x 69 cm², 81 colonies

✔ small distance genetic structure (IBD)
✔ 9 to 10 % of half-sib dyads depending on age class
✔ 5 and 4 parent offspring relationships depending on age class



Distances between parent - offsrping (1), half-sib (2) and unrelated colonies (3), in the sampling area
→ high level of auto-recruitment

✔ Reduced mean dispersal
✔ bi-parental inbreeding
✔ Aquarium experiments and phylogeography : rare long distance dispersal ?

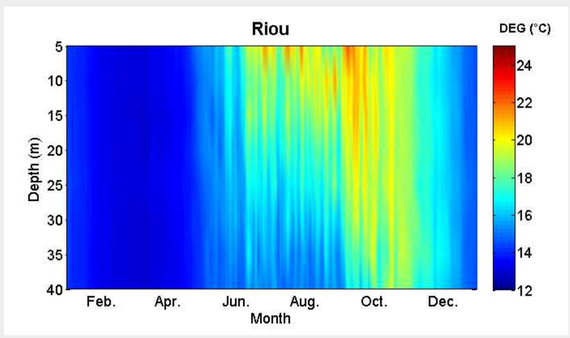
Impact of density decrease on population dynamics?
comparative approach between a pristine like and a declining population:
-no significant difference in mating pattern and genetic drift →gamete dispersal buffers density decrease?
-BUT trend toward higher inbreeding and drift in declining population

➢ mainly local genetic and demographic population evolution

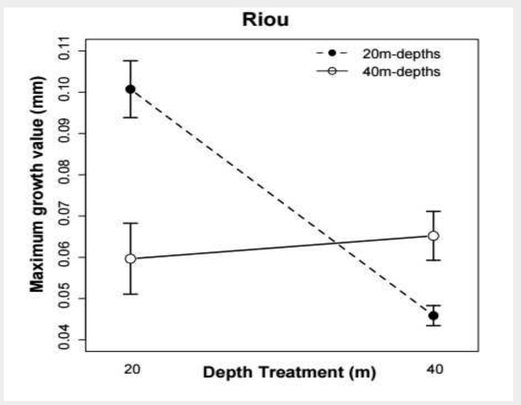
Garrabou et al., 2002, 2017 ; Ledoux et al., 2010 a,b ; Martinez-Quintana et al., 2015 ; Pratlong et al. 2017 ;, submitted

Adaptive diversity

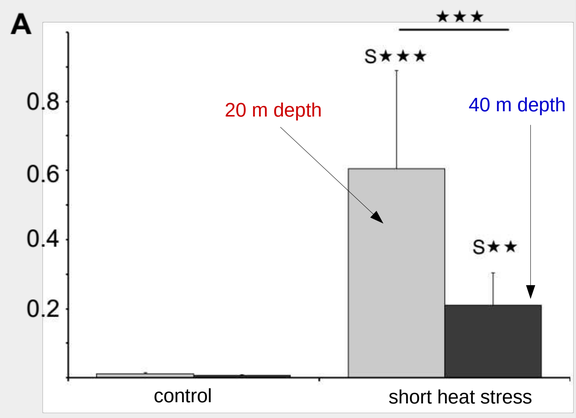
Environment heterogeneity → local adaptation?



Thermal regime Marseille 1999 – 2011
Genetically different populations / environment
Higher and more variable temperature in shallow vs deep conditions

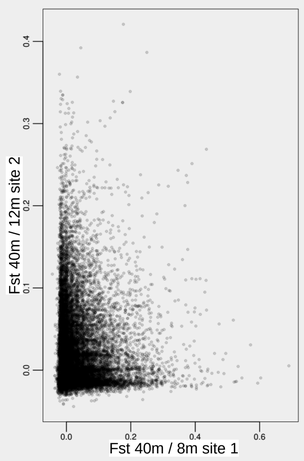


Reciprocal transplants
(in situ ; growth)



Common garden
(experimental ; HSP70 expression)

✔ phenotype of local adaptation (Pst > Fst) in Marseille, not Corsica
✔ transcriptome differences in control conditions
✔ RAD-Seq →outlier loci (Arlequin, pcadapt)



RAD-Seq loci plots of Fst values for two comparisons between depths(20 - 40 m) in Marseille

Strong genetic structure / drift
Candidate selected loci
... but false positive...

➢ diversity of adaptive phenotypes
➢ fuel for future acclimatization or genetic adaptation

Ledoux et al., 2014 ; Haguenauer et al., 2013 ; Pratlong et al., 2015 ; Pratlong et al., submitted

Management rules : no dredging, minimum size 7 mm basal diameter, no harvest shallower than 50 m depth (Tsounis et al., 2013)
Need to include extended depth gradients in protected area ; take into account connectivity between populations and environments
Restoration actions : high density patches of "resistant colonies" ?
Extend population modeling including demography and genetics