



Unresolved Questions in Red Coral Biology: Growth Dynamics, Climate Resilience, and Deep- Mortality

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At the end of the introduction to his *Histoire naturelle du corail*, H. Lacaze-Duthiers wrote “*Le Corail a été comme prédestiné a soulever des controverses, et cela aussi bien au point de vue scientifique qu’au point de vue de son industrie*”. This observation remains strikingly relevant today: despite more than a century of research, many aspects of the biology and ecology of this iconic organism are still poorly understood. These persistent knowledge gaps hinder accurate assessments of the conservation status of coral banks and complicate the development and implementation of effective, sustainable fisheries management strategies. In particular, growth rates and the environmental factors that control them remain insufficiently characterized. Existing evidence points to the influence of substrate type, depth, and other local conditions that are still poorly understood, but their relative importance has yet to be clearly defined. From this perspective, it is somewhat paradoxical that the coral banks of western Sardinia—among the most intensively exploited for centuries—continue to be the most productive, both in terms of abundance and colony size. In contrast, many other historically exploited banks exhibit clear signs of decline, in some cases resulting in the local extinction of the species.

Another unresolved issue concerns the resilience of coral populations to ongoing climate change. Long-term observations from the Portofino MPA, spanning more than 60 years, document a gradual increase in colony size accompanied by a decrease in density, as expected in populations approaching a mature structure. However, in recent years—likely linked to the increasing frequency of marine heatwaves—both colony size and density have declined markedly, raising concerns about long-term persistence.

Finally, the occurrence of extensive mass mortalities at greater depths affecting entire banks are particularly difficult to interpret and pose significant concerns for the conservation of deep coral populations.