International consensus statement

Less sex on coral reefs?

What we know, what we need to know about coral physiology and reproduction for the future of coral reefs

FONDATION D'ENTREPRISE TOTAL

Scientific Context

Global changes are threatening the survival of coral reefs worldwide and it is uncertain whether corals will be able to survive to the changes occurring in the marine environment in the 21st century. Scleractinian corals play a pivotal role in coral reef ecosystems, by building the structural foundation of the reef. They provide a habitat to a wide range of marine species and they have therefore a key role in maintaining biodiversity. However the fragility of the Scleractinian corals to environmental stressors raises a growing concern regarding the capacity of corals to sustain the increasing frequency of assaults associated with anthropogenic activities at global and local scales (e.g. global warming, pollution, ocean acidification).

In this context and due to the importance of conserving the diversity of Scleractinian corals and of coral reef ecosystems worldwide, the purpose of this international workshop was to bring together coral researchers of various disciplines (molecular biology, reproductive biology, physiology, ecology) to share the most recent research findings related to coral physiology and reproduction in a changing world. This workshop was attended by internationally well-known scientists from different countries around the world (Australia, United-States, Mexico, Monaco, England and The Netherlands).

This workshop led to an international consensus statement on what we know and what we need to know on coral physiology and reproduction for the future of coral reefs. This international consensus statement stimulated new ideas and synergistic interactions among disciplines and shed light on the next challenging questions for coral research that should be prioritized and funded by national and international agencies to help preserve the diversity of corals worldwide.

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The **survival** of reef building corals depends on the **successful symbiosis with zooxanthellae and heterotrophic nutrition** to support growth, calcification and reproduction.

The world's corals reefs and the ecosystem services they provide (coastal protection, food, biodiversity, tourism) are facing increased threats from **global climate change and other human activities**. Rapidly changing environment interacting with increased human pressures are overwhelming the capacity for some coral species to survive in the future.

Key threats to coral reefs include rising seawater temperature that cause mass coral bleaching and coral death; and ocean acidification that reduces the rate at which corals and coralline algae can calcify and effectively build reefs.

Although many coral communities have been degraded, some reefs remain in good condition and provide **hope for the future**. A coral is a "**holobiont"** that is a complex networks of interacting animal polyps, algae, bacteria, fungi and viruses. More than 1000 species of corals contribute to reef formation, each one expressing various level of sensitivity to global changes – therefore reefs will look very different in the future.

Successful coral reproduction is essential for maintaining, renewing and restoring coral populations, but we know that coral reproductive processes are highly **sensitive to stress** and these stresses will divert energy away from growth and reproduction.

Substantial global research is focused on ecosystem level phenomena and management, but we now need **deeper insights** into the key processes sustaining coral communities.

Among many aspects of coral ecology that we need to better understand are how corals allocate their **energy to calcification, growth and reproduction**. We also need much better understanding of the microbial, physical and biological processes that strongly influence coral health and larval settlement. We urgently require better knowledge of the combined impacts of thermal stress, ocean acidification and pollutants on coral physiology and reproductive success.

Global change impacts require global action, but important actions should be taken at local scales to ensure successful coral reproduction and growth in our changing world.

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