Impacts of climate change and ocean acidification on marine ecosystems

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Ocean: considerable value

- **Moderates** climate change
- **Represents** more than 90% of Earth’s habitable space
- **Hosts** 25% of eukaryotic species
- **Provides** 11% of global animal protein consumed by humans
- **Protects** coastlines
- …
Ocean: actor and victim

- **Heat**
  - Melting ice: 3%
  - Continent: 3%
  - Atmosphere: 1%

- **Warming**

Ocean: 93%

[Diagram showing the distribution of heat sources with the ocean being the largest contributor.]
Ocean: actor and victim

Heat
- Melting ice: 3%
- Continent: 3%
- Atmosphere: 1%

Carbon dioxide
- Land: 29%
- Atmosphere: 43%
- Ocean: 28%

Warming

Acidification
Ocean: actor and victim

- Heat
  - Melting ice 3%
  - Continent 3%
  - Atmosphere 1%

- Carbon dioxide
  - Land 29%
  - Atmosphere 43%

- Water
  - Ocean ~100%

- Warming
  - Ocean 93%

- Acidification
  - Ocean 28%

- Sea level rise
Risks of impacts

Gattuso et al. (2015)

Cumulative fossil fuel emissions since 1850 (GtC)

Changes in the global average of sea surface pH and sea surface temperature

Global average sea surface temperature and pH at present and in 2100 according to the 3 RCPs.

Confidence levels for present-day and the 3 RCPs
4 key messages

1. The ocean strongly influences the climate system and is an important provider of key services

2. Impacts are already detectable, high risk of impacts are expected well before 2100, even with RCP2.6

3. Immediate and substantial reduction of CO₂ emissions are crucially needed to prevent massive and mostly irreversible impacts

4. As CO₂ increases, the protection, adaptation, and repair options become fewer and less effective