What does a more acid ocean mean for marine life?

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Winners and losers of ocean acidification

- CO₂ is the substrate for photosynthesis
- Threatens the existence of calcifying organisms
- Increasing CO₂ reduces the amount of carbonate ions in the oceans
In what ways and what extent are organisms affected?

- Makes building and maintaining calcium carbonate structures difficult
- Deformed and dissolved shells
- Inhibits growth of calcifying organisms

Busch et al. (2014) PlosOne
Huge test tubes: entire ocean plankton community

North Sea, Bergen
Ecosystems are changing under high $\text{CO}_2$

Present conditions

- Algae
- Sinking particles
- Protists
- Carbon flux
- Copepods
- Jellyfish
- Fish

Higher temperature and $\text{CO}_2$

- Algae
- Sinking particles
- Protists
- Jellyfish
- Copepods
- Fish

Some fish species cope poorly with high CO$_2$

Impact on fish larvae in many different ways:
• growth
• behavior
• fish’s ear bone formation

→ Lower fish stock

How does acidification affect Baltic Sea organisms?
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High resistance of organisms to CO\textsubscript{2}

- Phytoplankton
- Zooplankton abundance and egg production

Except for
- Mussels

Are organisms able to adapt to a more acidic ocean?

- High pH variation in the Baltic Sea selects for ocean acidification tolerant mussels

- Calcifying algae (*Emiliania*) is able to adapt to ocean acidification by means of evolution
  But only up to a certain level

How will ocean acidification affect us?

• Reduced fish stocks and low-quality fish
  • Fish is the main protein resource for 1 billion people, especially in developing country

• Destruction of coral reefs reduces important ecosystems
  • Habitat for millions of species
  • Tourism – source of income
  • Biodiversity for the future

• Impairs aquaculture of shellfish production (oysters, mussels)
  • Reduced growth or kills of larval stages
  • Economical impacts
Thank you for your attention