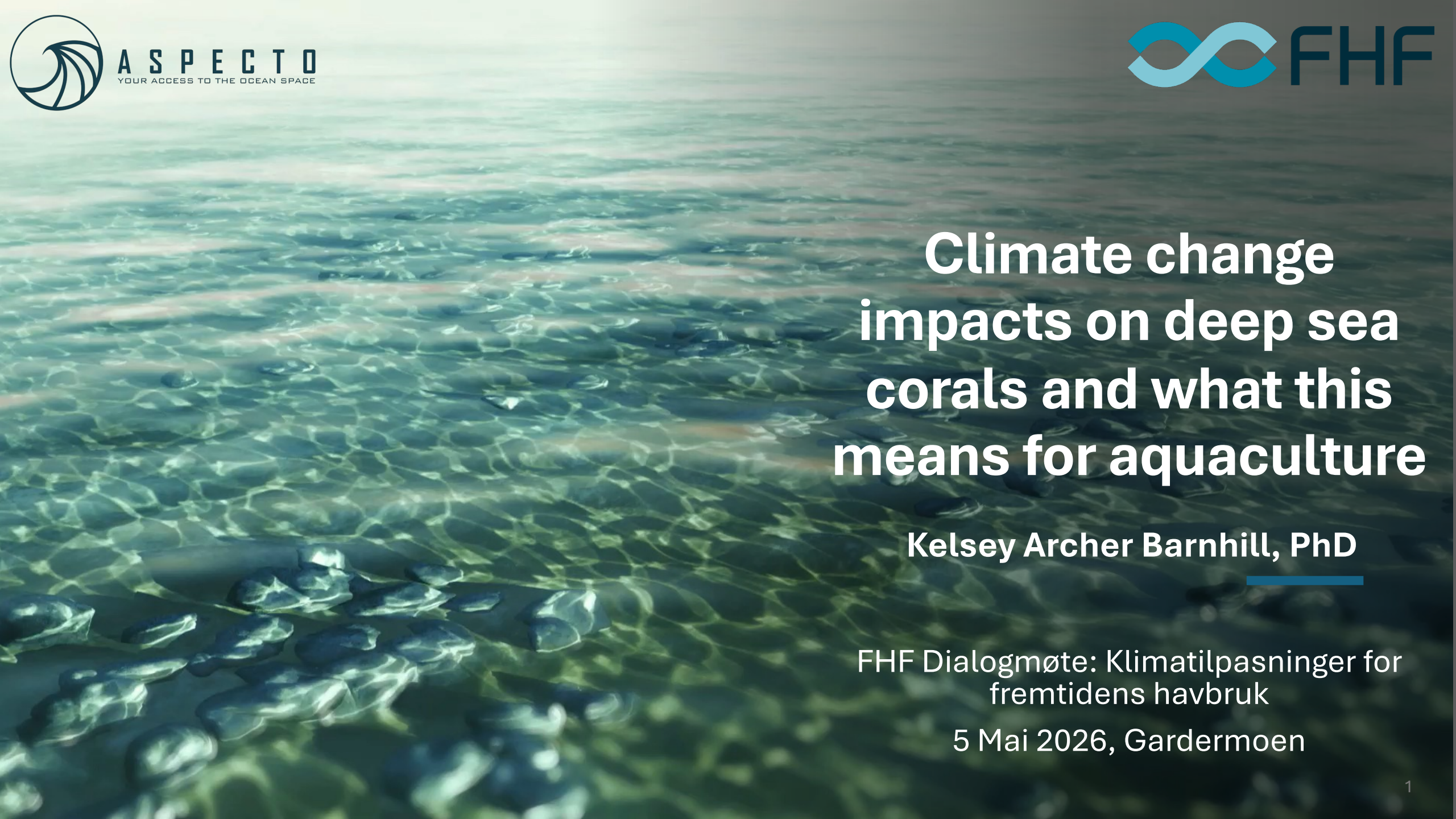


Climate change impacts on deep sea corals and what this means for aquaculture

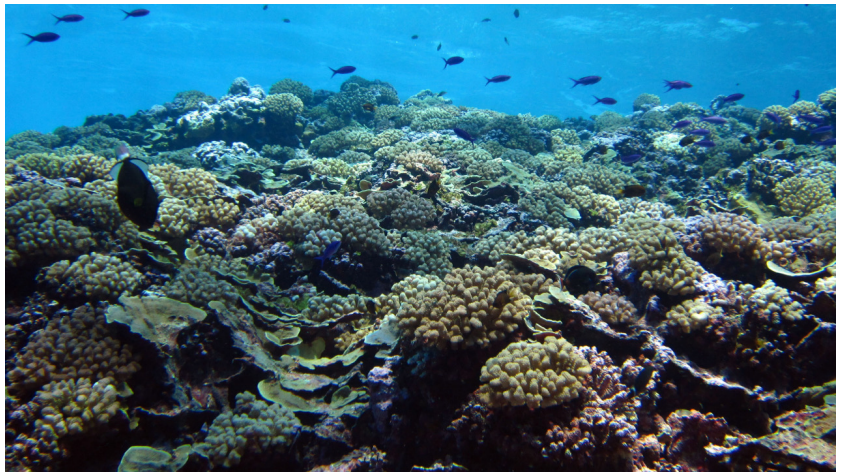
Kelsey Archer Barnhill, PhD

FHF Dialogmøte: Klimatilpasninger for fremtidens havbruk

5 Mai 2026, Gardermoen

Types of Corals

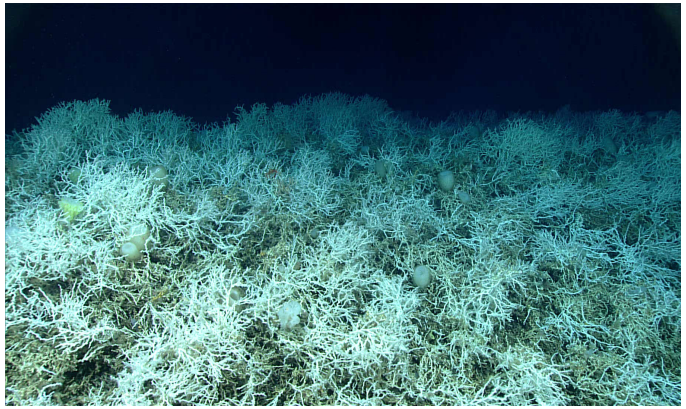
Shallow/Tropical



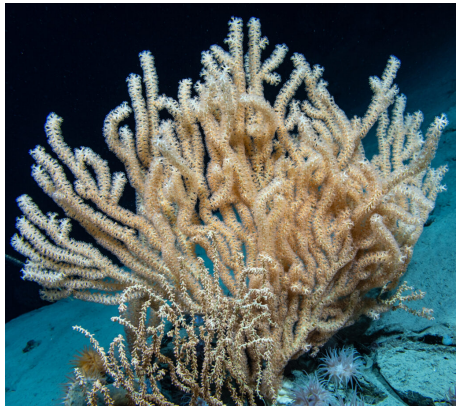
Reef Building

Non-Reef Building

Deep/Cold-Water



Reef Building



Non-Reef Building

Images from NOAA

Reef Building Corals under Climate Change

Can reefs keep building under future conditions?

Temperature

- Short-term warming can increase coral stress and mortality, while long-term studies suggest partial acclimation.

Oxygen

- Deoxygenation negatively affects coral health, although some reefs naturally occur in low-oxygen waters.

pH

- Ocean acidification weakens reef framework, though live corals persist.

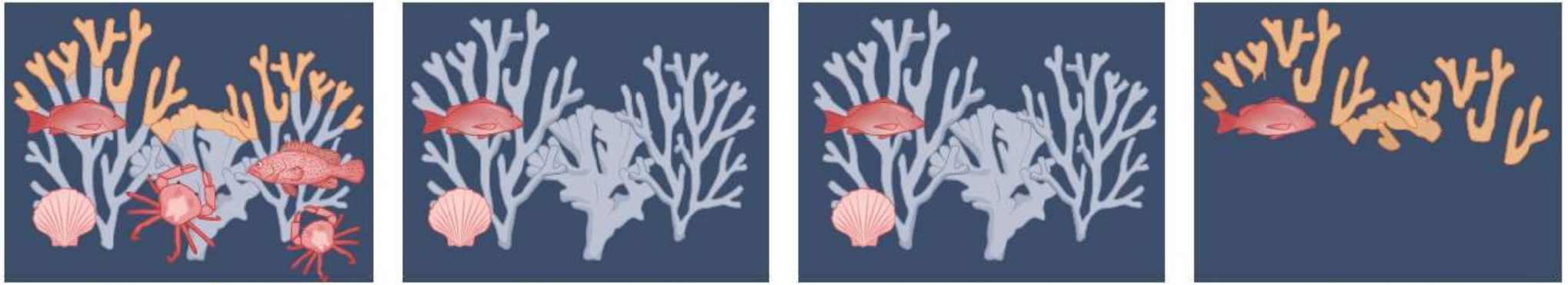


Image from Barnhill et al., 2023

Reef-Building Corals Summary

- pH is often viewed as the primary climate change-driven concern.
  - Deeper reefs are expected to be impacted earlier than shallow Norwegian fjord reefs due to ocean acidification.
  - Impacts predicted around 2070 for shallow fjord depths
- Access to food supply can help mitigate impacts from other stressors, though climate change can impact food supply – (changes in surface productivity)
- Combined stressors drive larger impacts than single stressors alone.

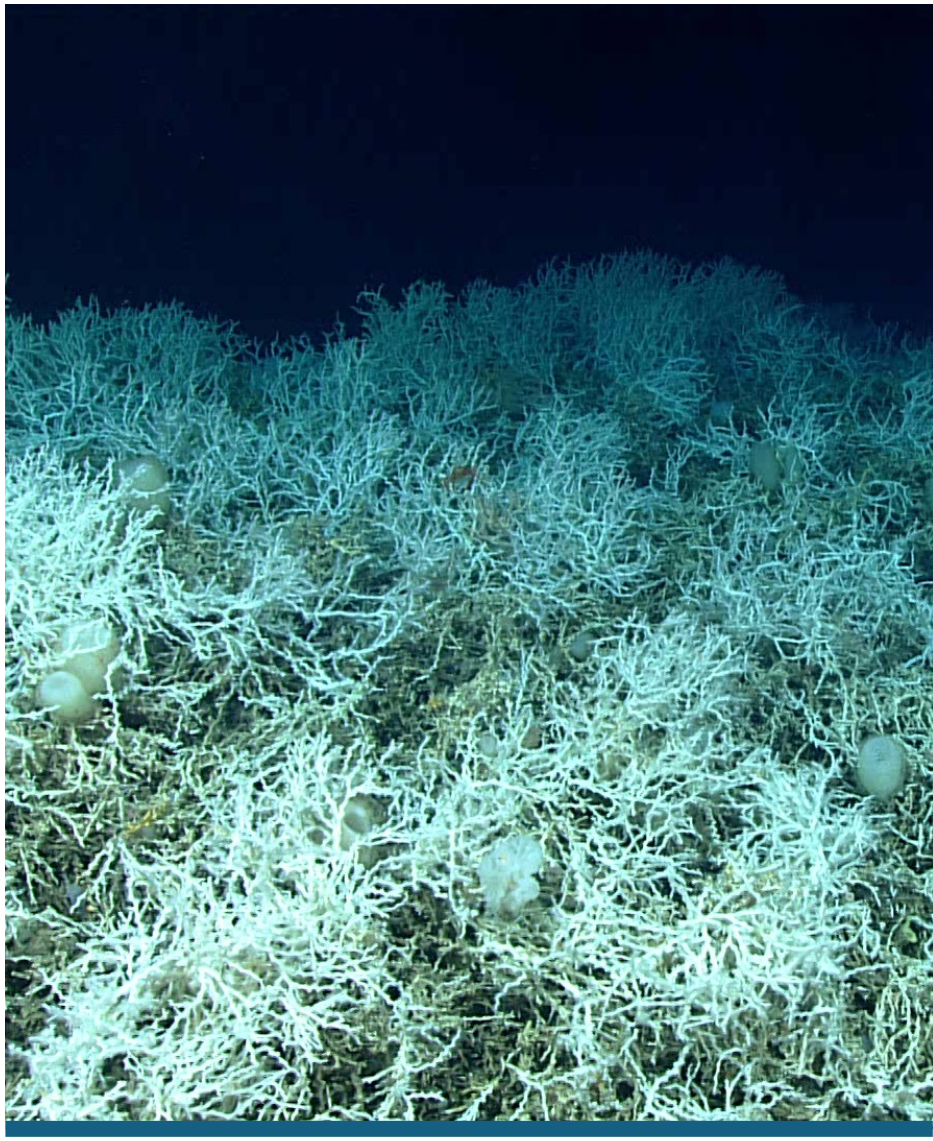


Image from NOAA

Non-Reef Building Corals under Climate Change

Image from NOAA

- Warming & decreased oxygen are likely larger threats than decreased pH
  - Higher temperatures will likely occur in shallow fjord settings first
  - Climate change can impact food supply – (changes in surface productivity)
- Higher uncertainty compared to reef building corals

*Relatively limited research done to understand non-reef forming coral responses to climate change

Coral Resilience

- Corals are seen as vulnerable to change since they are long-lived and slow growing
- Experiments show ability to acclimatize to environmental change within a certain range
- Energy availability can buffer stress
- Exposure to variability can support tolerance
- Large, rapid changes or multiples stressors combined can exceed their ability to adapt
- Corals are resilient, but they have limits

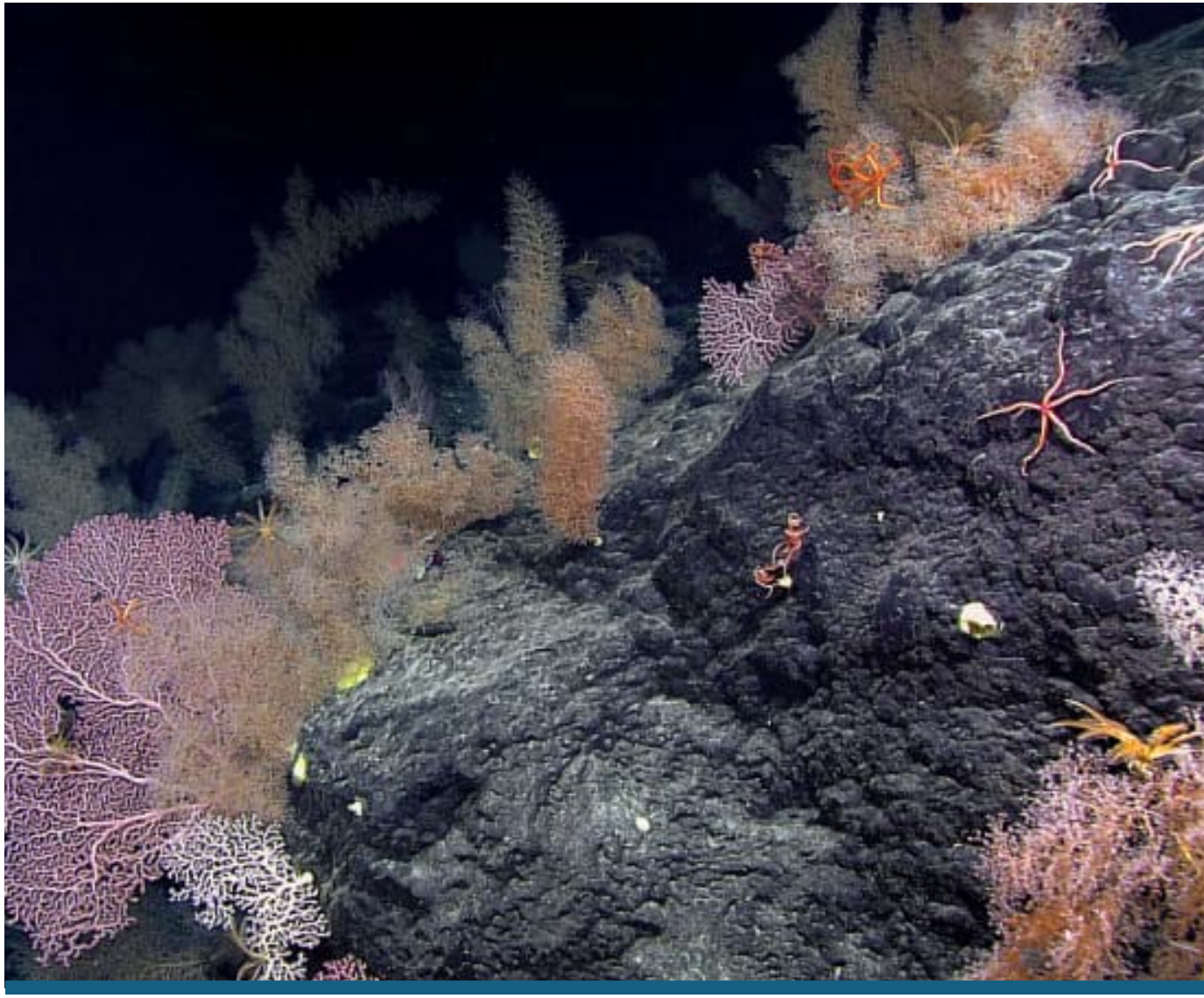


Image from NOAA

What Does This Mean In Practice?

- Climate change may shift coral habitat suitability
- Understanding local conditions becomes increasingly important
- Sedimentation is a key factor to understand in aquaculture settings
- Coral response depends on local conditions and species sensitivity
- Most aquaculture-derived particles settle close to cages
- Corals and aquaculture already coexist across the Norwegian coast

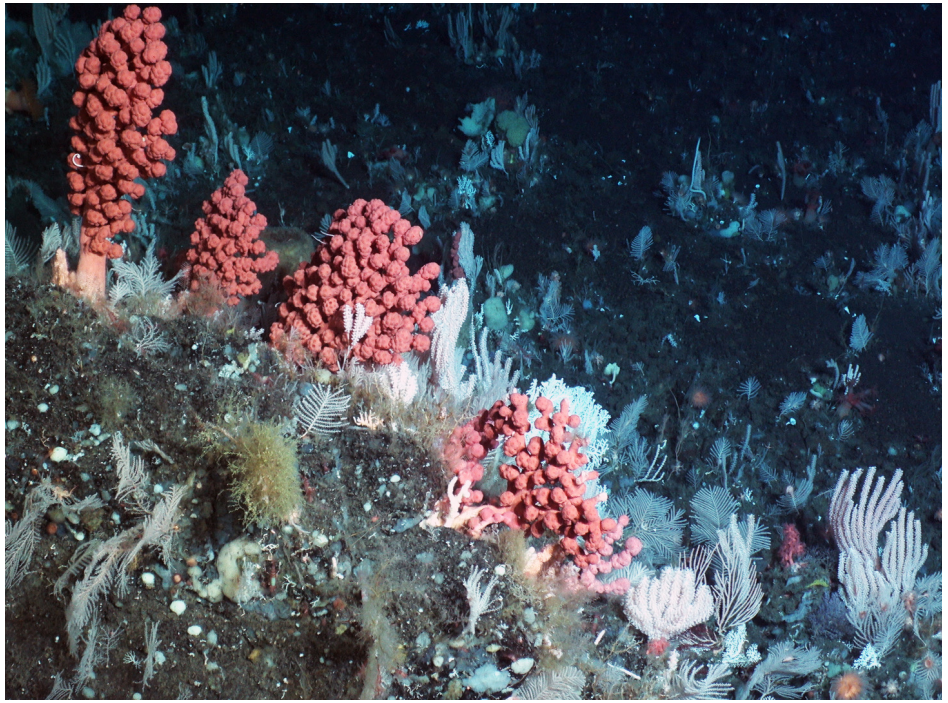


Image from NOAA

Monitoring Programs as a Tool to Quantify Coral Health

- Sedimentation
- Biodiversity/Ecosystem Function
- Mucus production
- Discoloration
- Polyp activity
- Tissue coverage & mortality
- Growth rate
- Physical samples

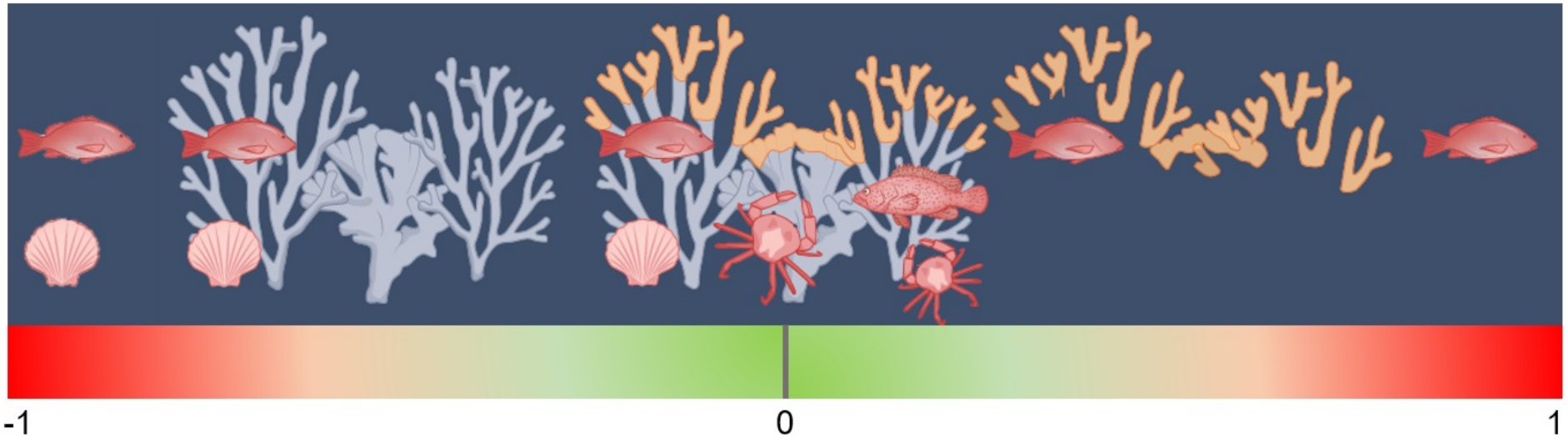
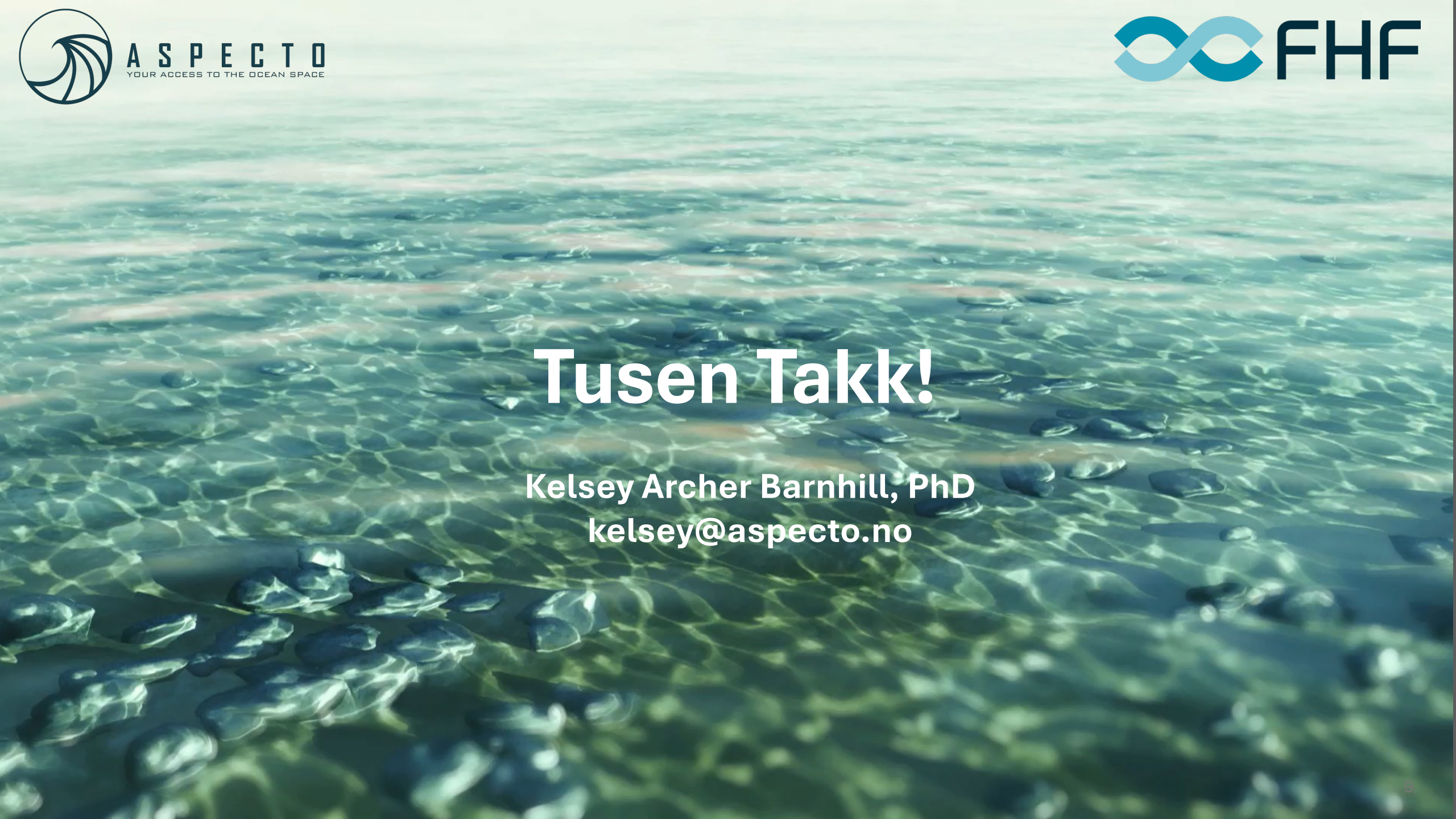


Image adapted from Barnhill et al., 2023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9