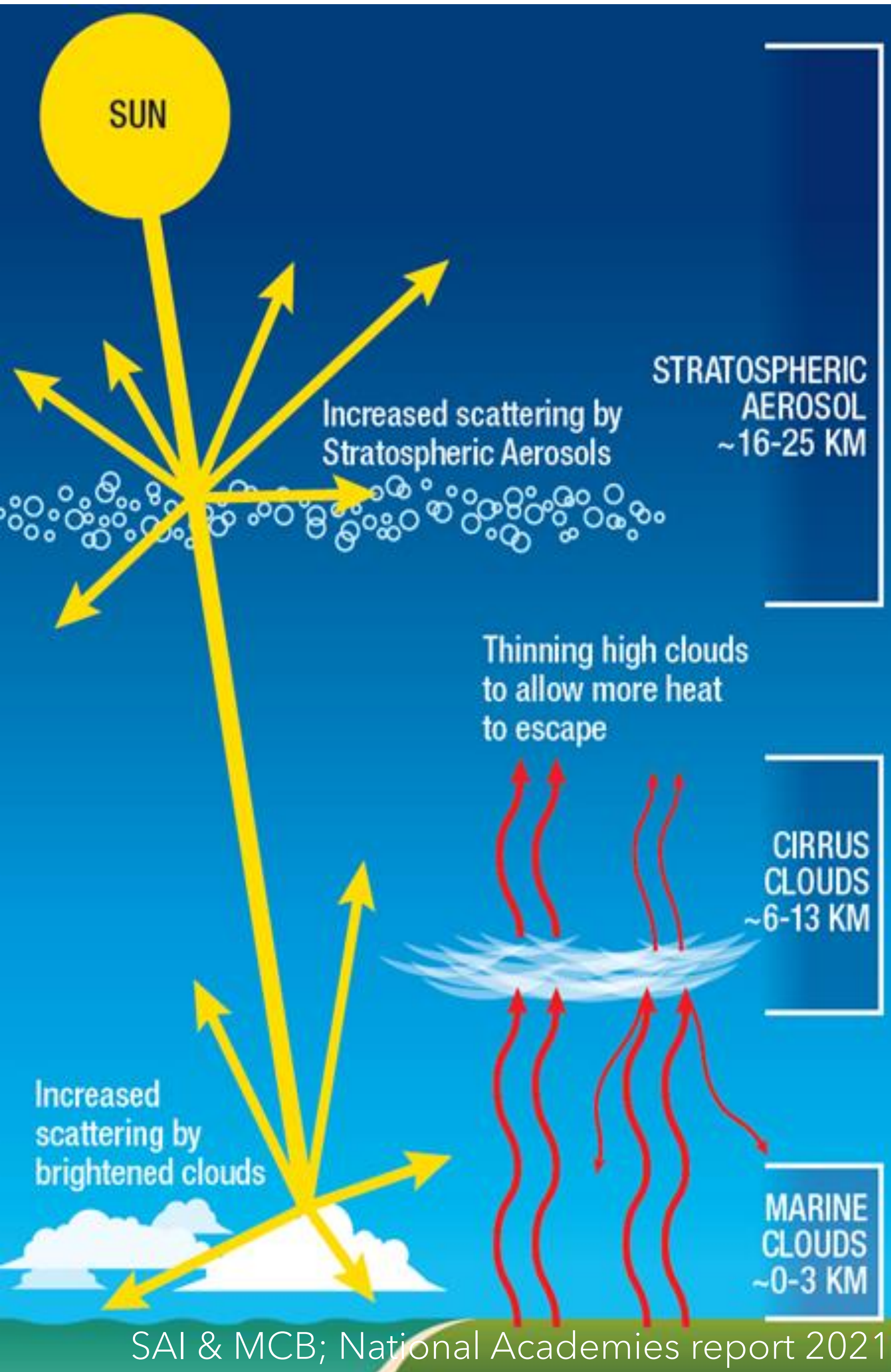


WHAT ARE THE MARINE ECOSYSTEM IMPACTS OF GEOENGINEERING?

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HIGHLIGHTS

- Research and implementation of geoengineering moving forward faster than oversight
- High degree of uncertainty in how marine systems will respond to geoengineering scenarios
- We need holistic and cross-disciplinary investigation of impacts

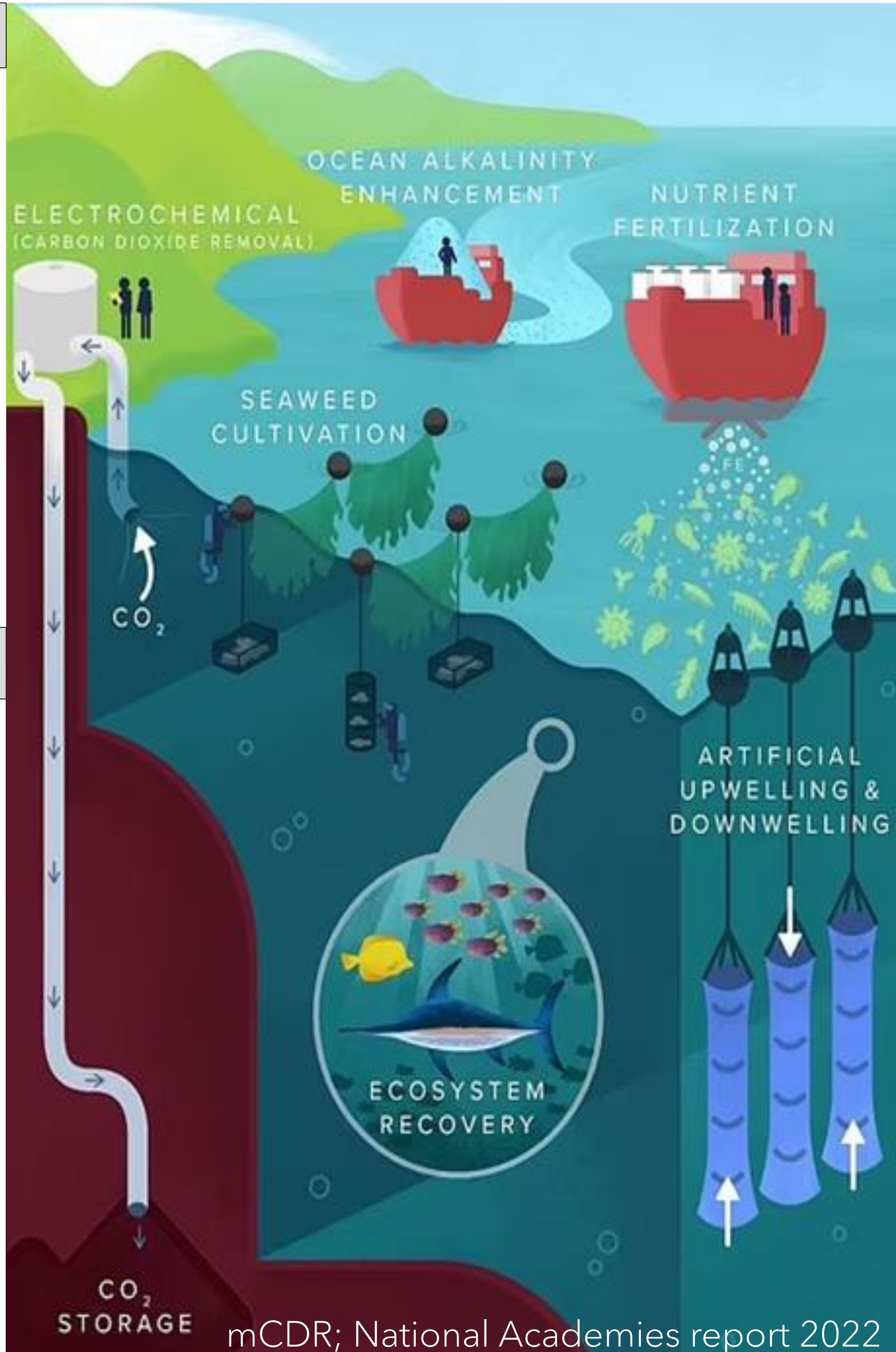
BACKGROUND

Geoengineering = deliberate large-scale manipulation of the environment to counteract anthropogenic global warming and maintain temperature targets

Types of geoengineering we're interested in:

- Stratospheric Aerosol Injection (SAI)
- Marine Cloud Brightening (MCB)
- Marine Carbon Dioxide Removal (mCDR)

The potential tradeoffs of geoengineering on marine ecosystems must be explored to determine plausible scenarios or provide 'exit ramps' for discontinuing research & avoiding implementation

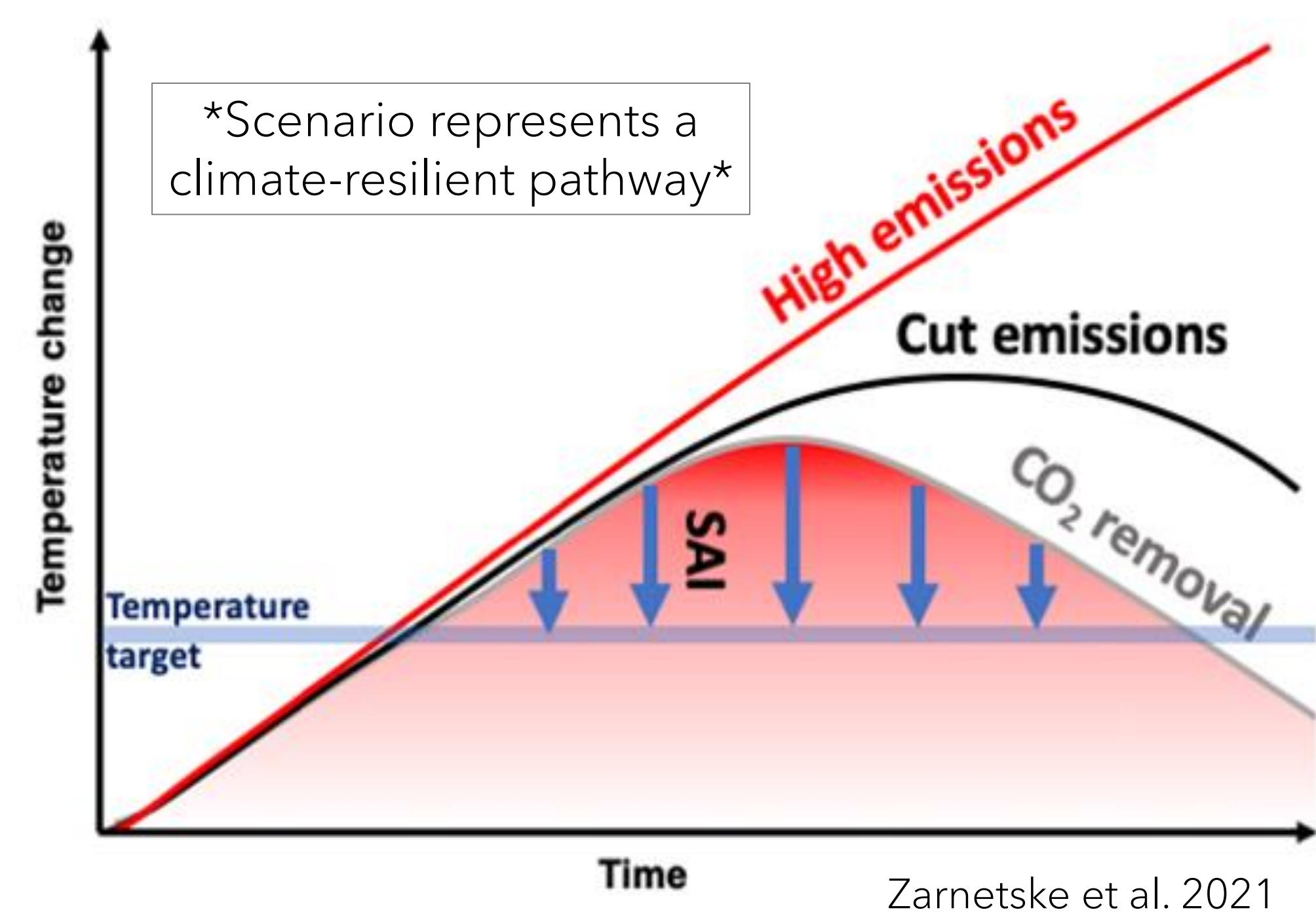


Seaweed cultivation: producing macrophyte biomass and transporting that carbon into a reservoir such as the deep sea or sediments

Alkalinity enhancement: chemical alteration of seawater chemistry via addition of alkalinity through various mechanisms

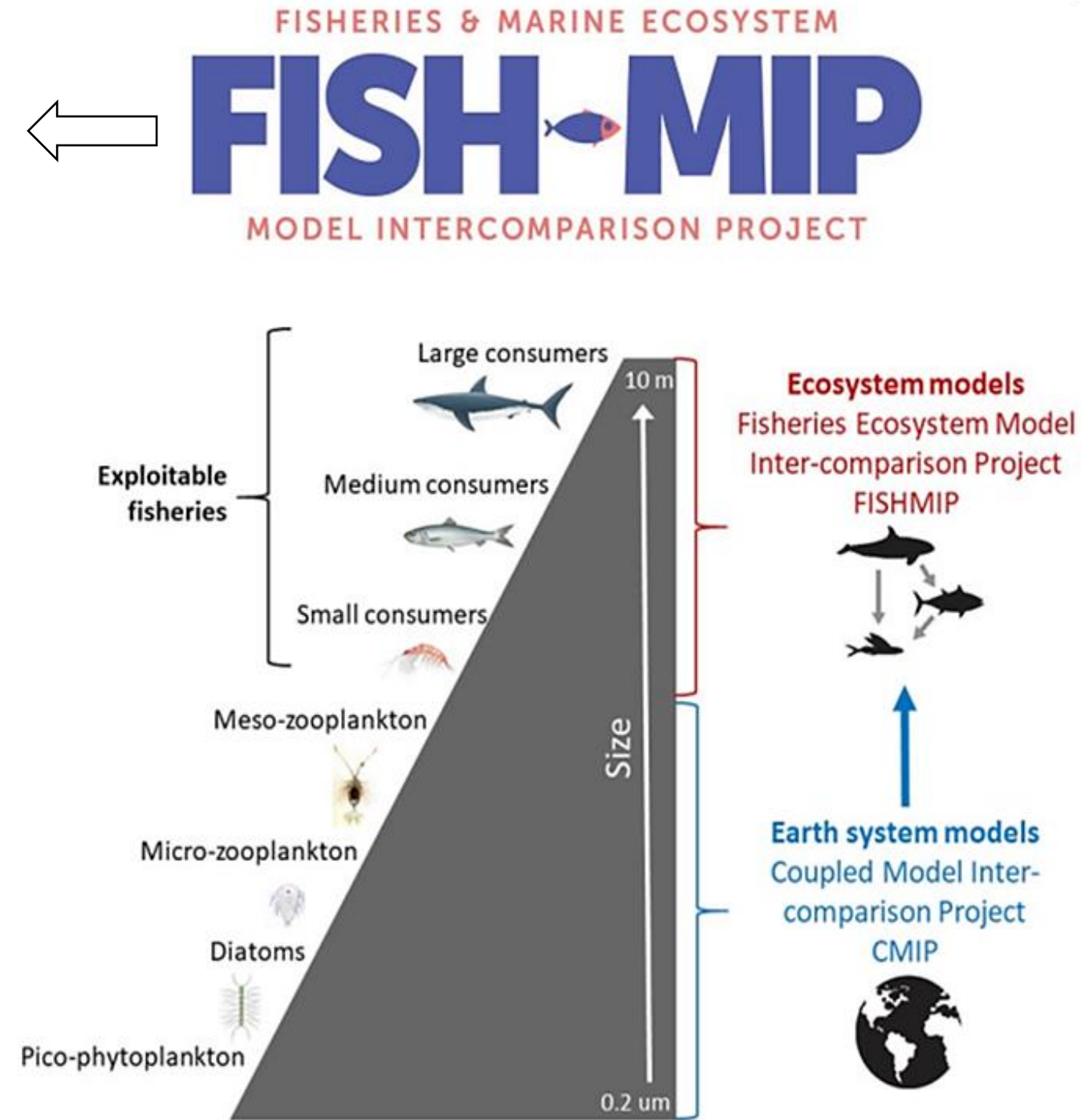
Stratospheric aerosol injection: increasing the number of liquid or solid particles (e.g., sulfate) in stratosphere to reflect sunlight (*analogue: volcanic eruptions*)

Marine cloud brightening increasing the reflectivity of low clouds over certain parts of the ocean (*analogue: ship tracks*)



Overshoot "peak-shaving" scenario:

1. Temperatures reduced with emissions reduction and mitigation
2. Gigatons of carbon scrubbed from atmosphere through CDR technologies
3. SAI deployed to avoid tipping points (i.e., save the land ice)



ONGOING WORK

- Use output from Community Earth System Model (CESM) simulations of SAI and MCB (ARISE 1.5; SSP2-4.5) to drive global fisheries models (**Fish-MIP**) and explore impacts to the spatiotemporal fish biomass distribution (Tittensor et al. 2021; Heneghan et al. 2021)
- Evaluate risk to marine ecosystems under SAI and MCB simulations using pre-existing metrics (i.e., thermal habitat loss, time to hazardous exposure, ecosystem disruption) from Boyce et al. 2022 'A climate risk index for marine life'