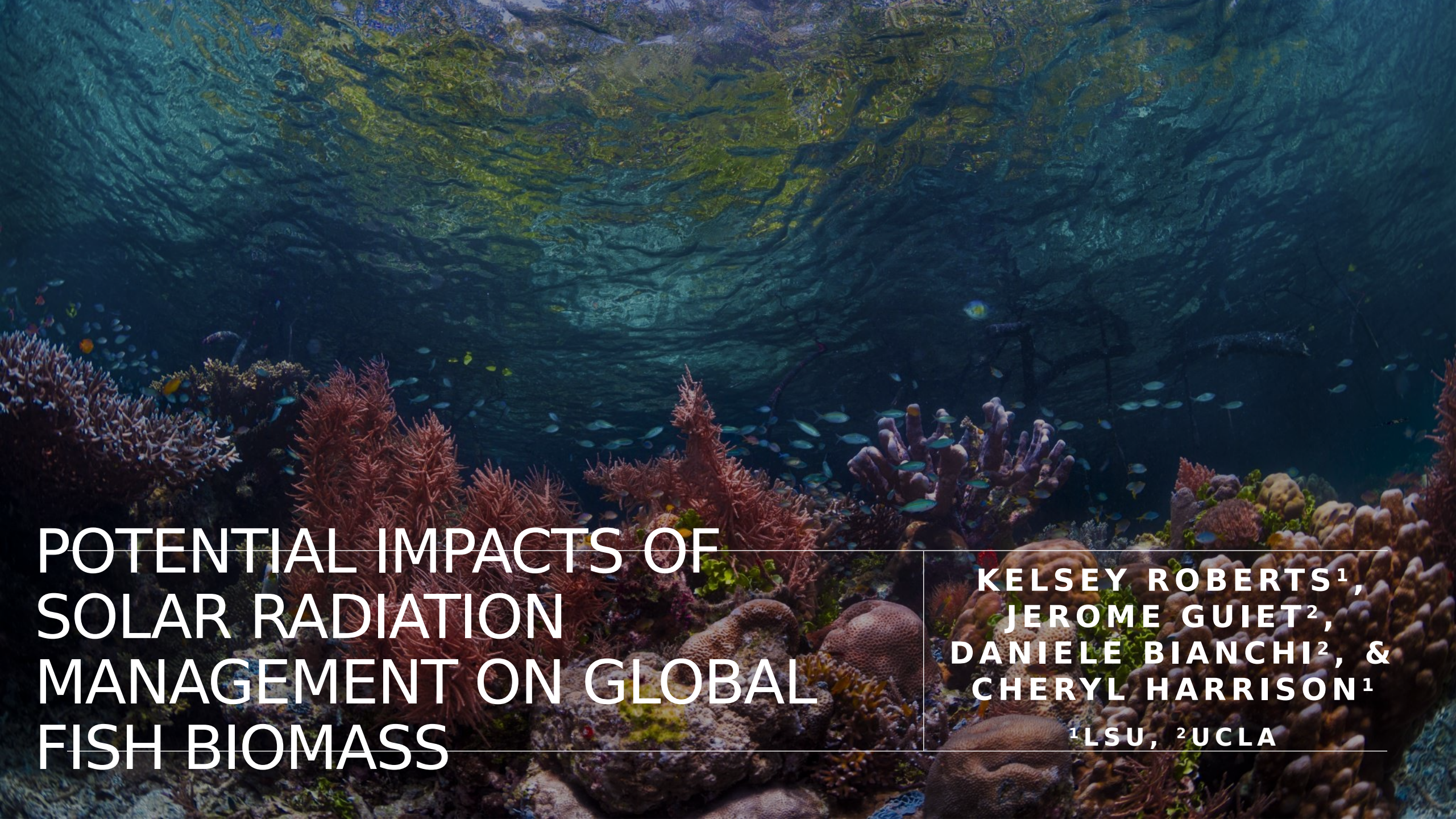
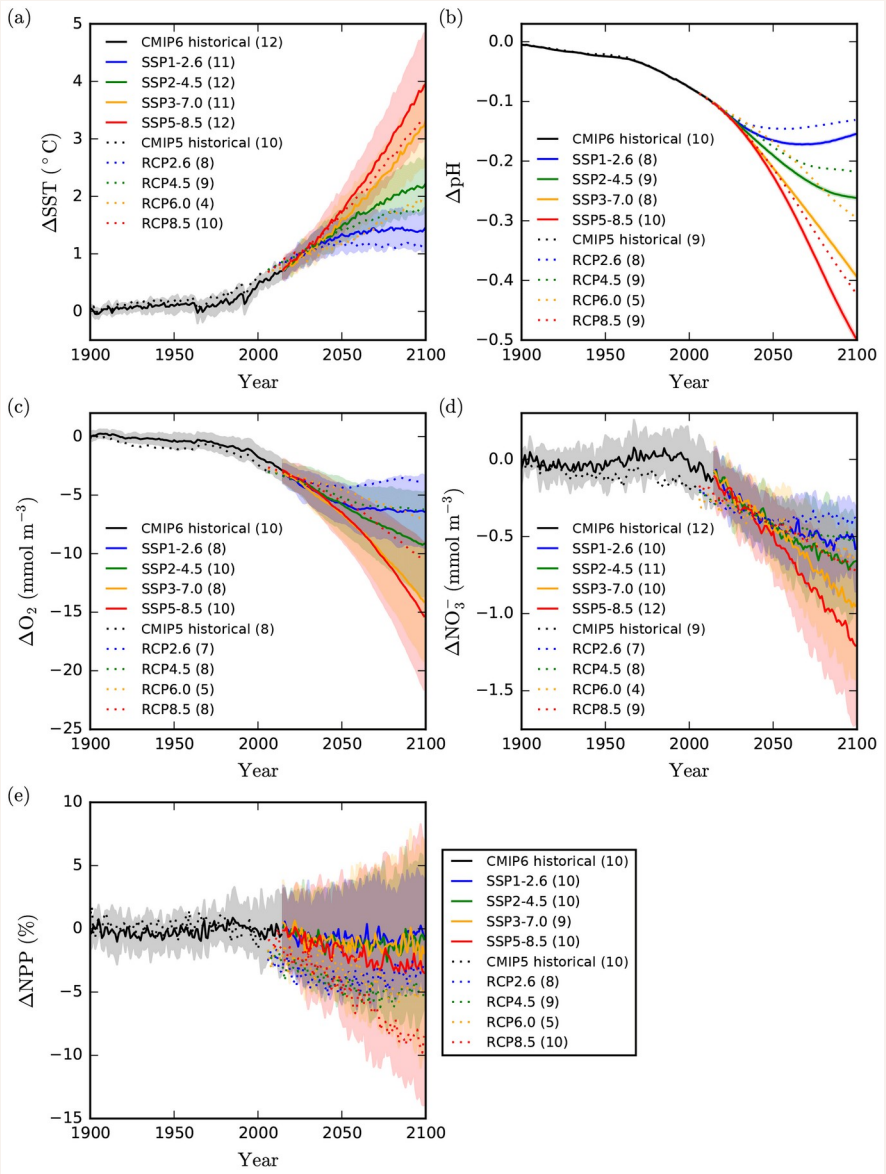


POTENTIAL IMPACTS OF SOLAR RADIATION MANAGEMENT ON GLOBAL FISH BIOMASS

KELSEY ROBERTS[1], JEROME GUIET[2], DANIELE BIANCHI[2], & CHERYL HARRISON[1]

[1]LSU, [2]UCLA

Important climate drivers for marine ecosystem impacts



a) Increasing SST

b) Acidification

c) Declining oxygenation

d) Declining surface nutrients

e) Uncertainty surrounding NPP response

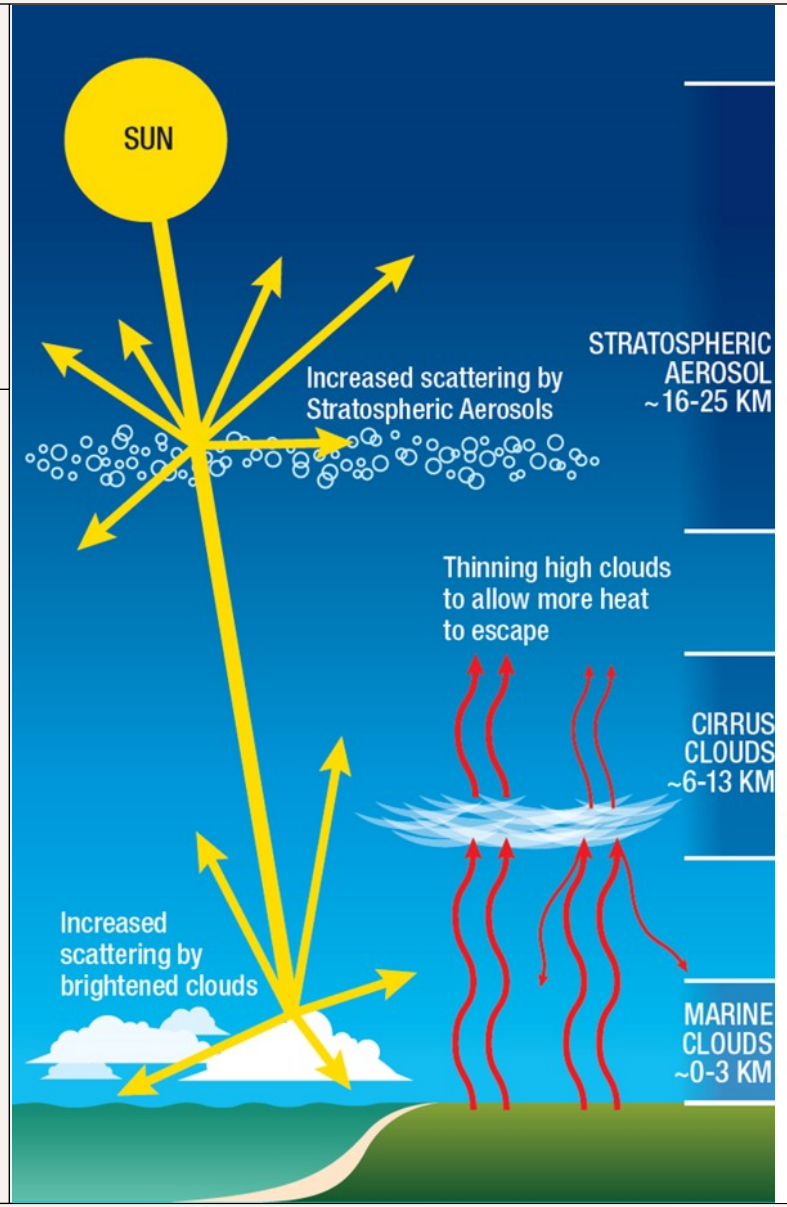
Kwiatkowski et al. 2020

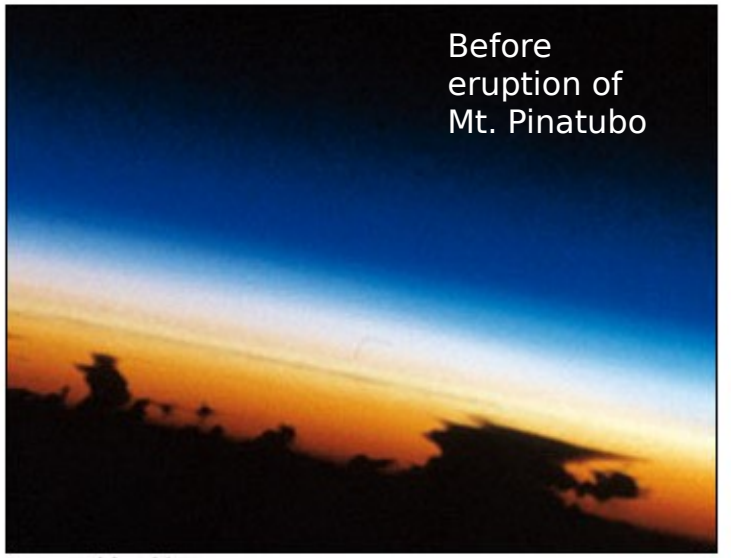
What is solar radiation management (SRM)?

SRM = limiting radiation at the Earth's surface (in other words…'turning down the sun')

1. Stratospheric aerosol injection (SAI) - increasing the number of liquid or solid particles (e.g., sulfate) in stratosphere to reflect sunlight (*analogue: volcanic eruptions*)
2. Marine cloud brightening (MCB) - increasing the reflectivity of low clouds over certain parts of the ocean (*analogue: ship tracks*)

Why do we care? Research & implementation is moving forward faster than oversight





August 30, 1984

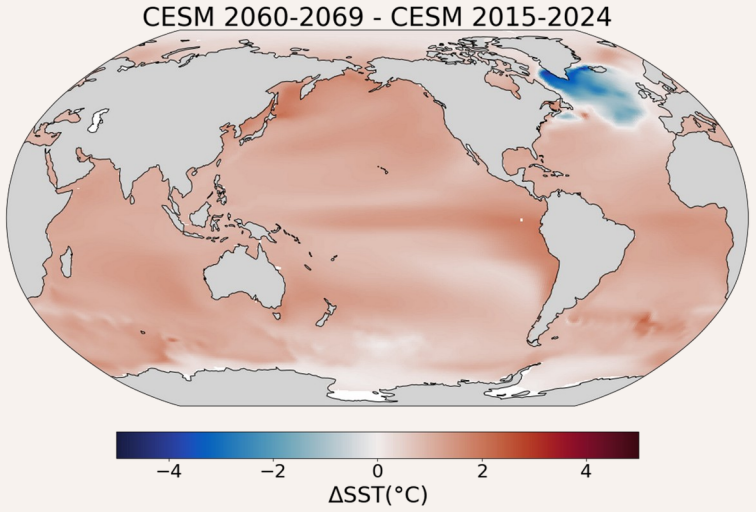
August 8, 1991

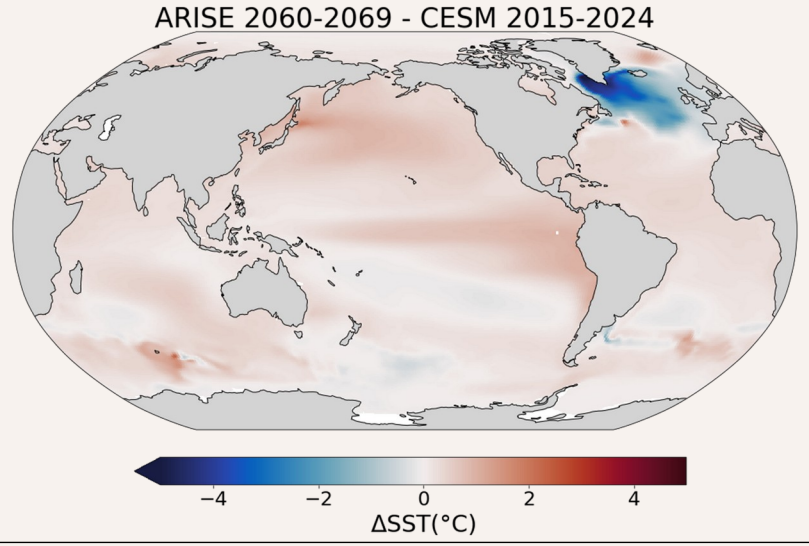
National Academies report, 2021, *Reflecting sunlight*

How does implementing SRM impact SST and NPP?

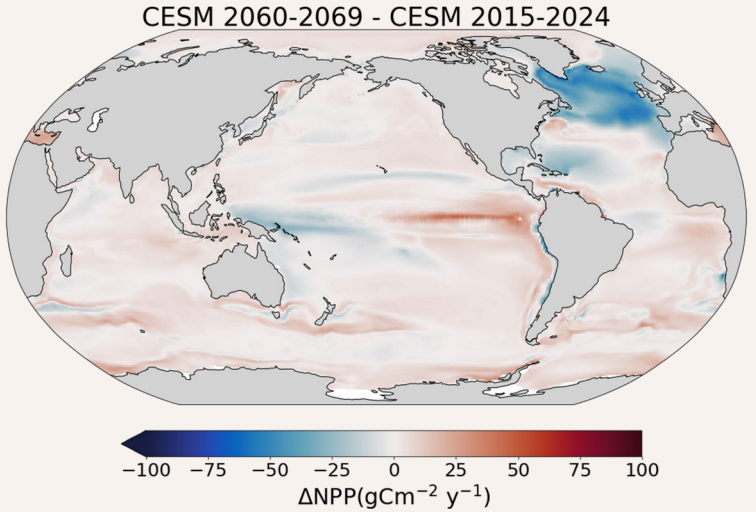
NO SRM

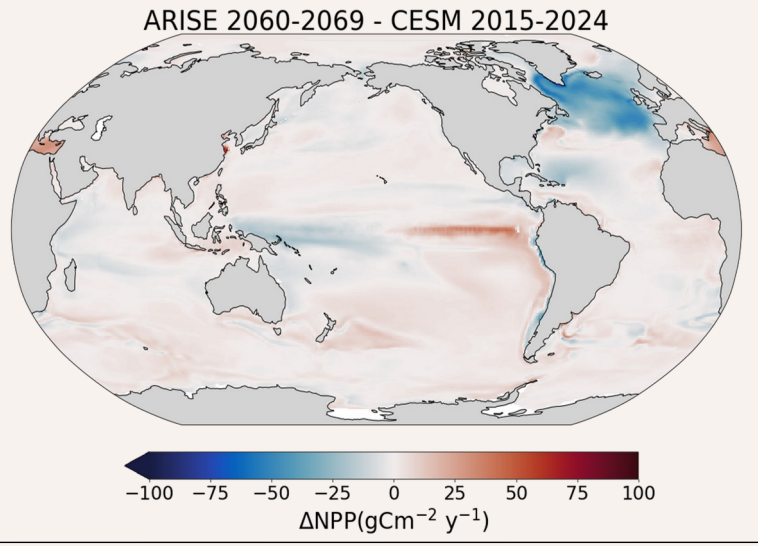
WITH SRM





- SAI can (mostly) bring temperature down to target (1.5 above pre-industrial)
- ‘Cold pool’ in North Atlantic – we don’t fully know what’s going on here
- NPP anomalies mitigated in some regions

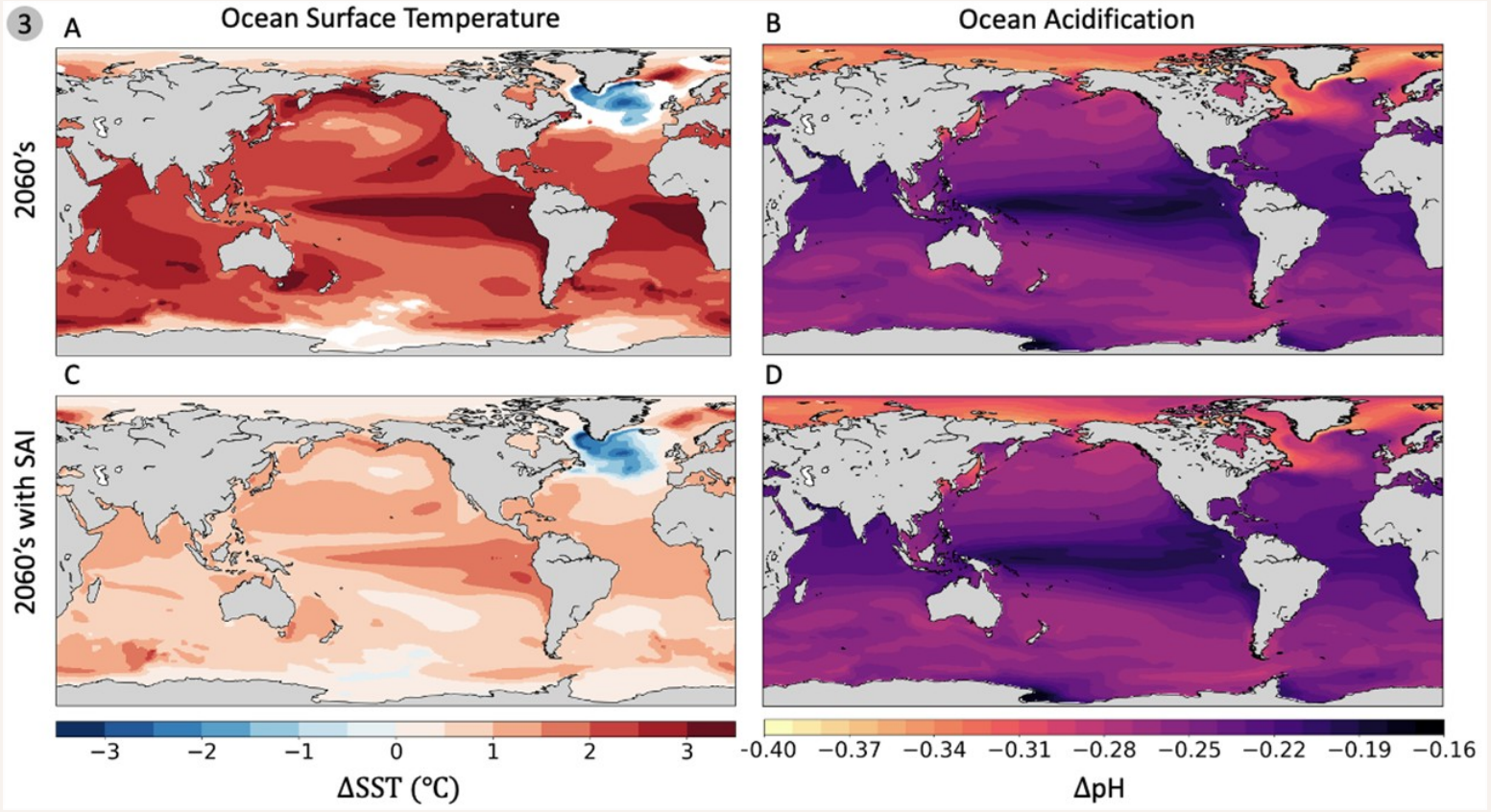




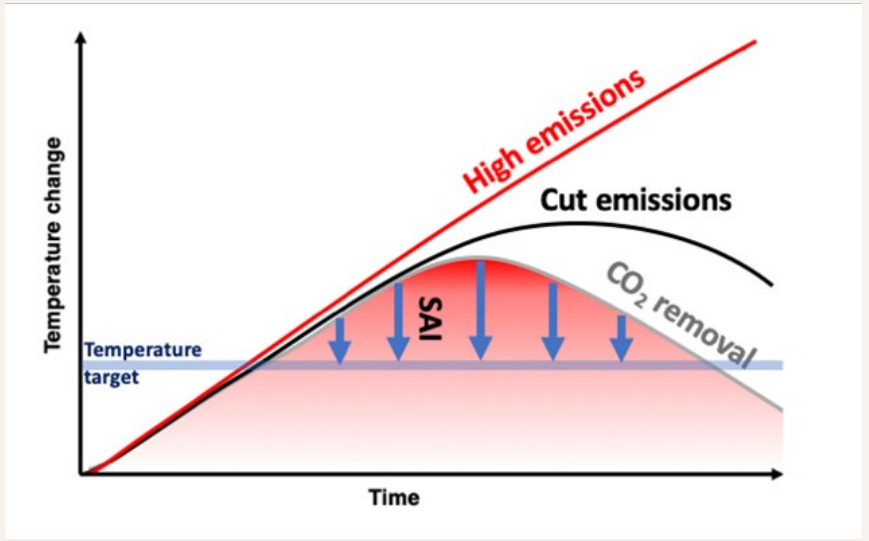
TEMPERATURE

NPP

Solar radiation management does not mitigate ocean acidification



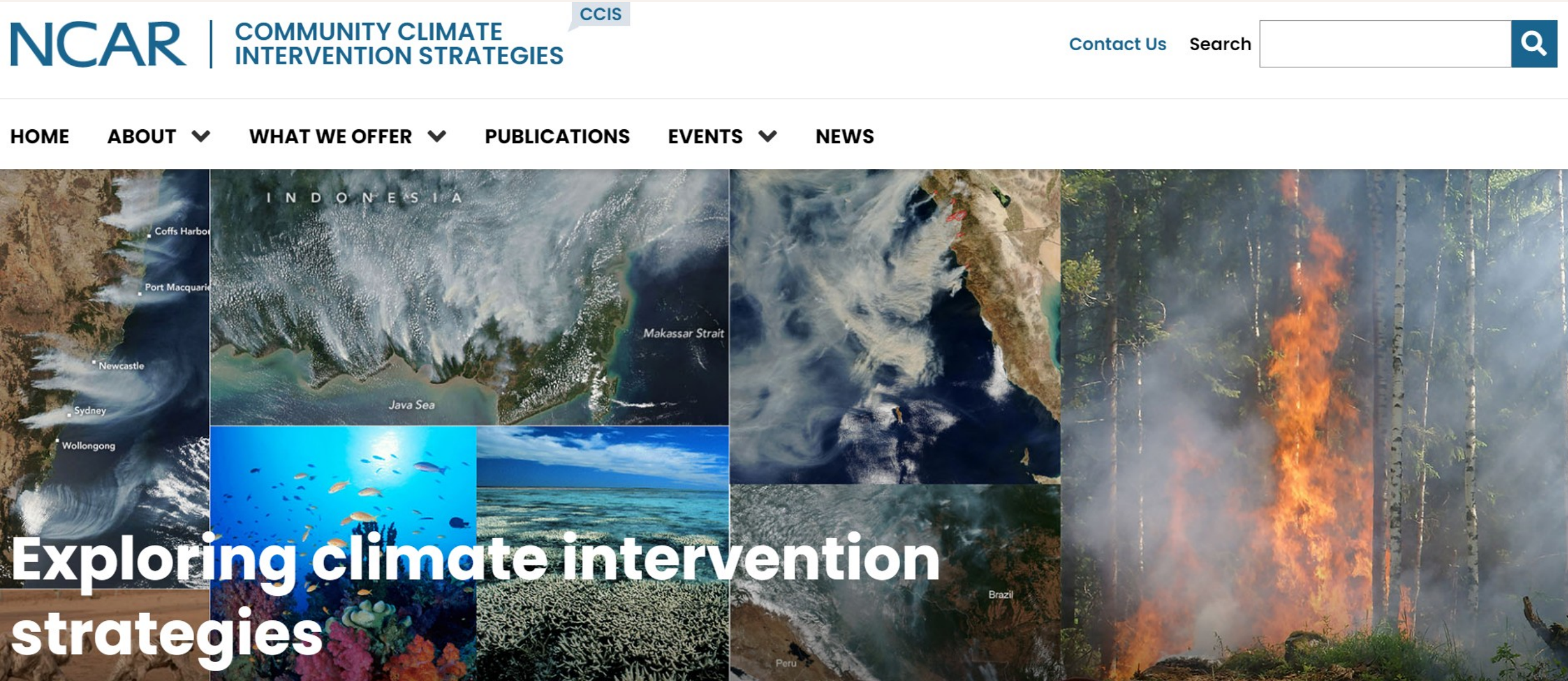
Overshoot "peak shaving"



*This also has the unfortunate side effect of lowering/worsening aragonite saturation – you could end up with a cooler but more acidic ocean

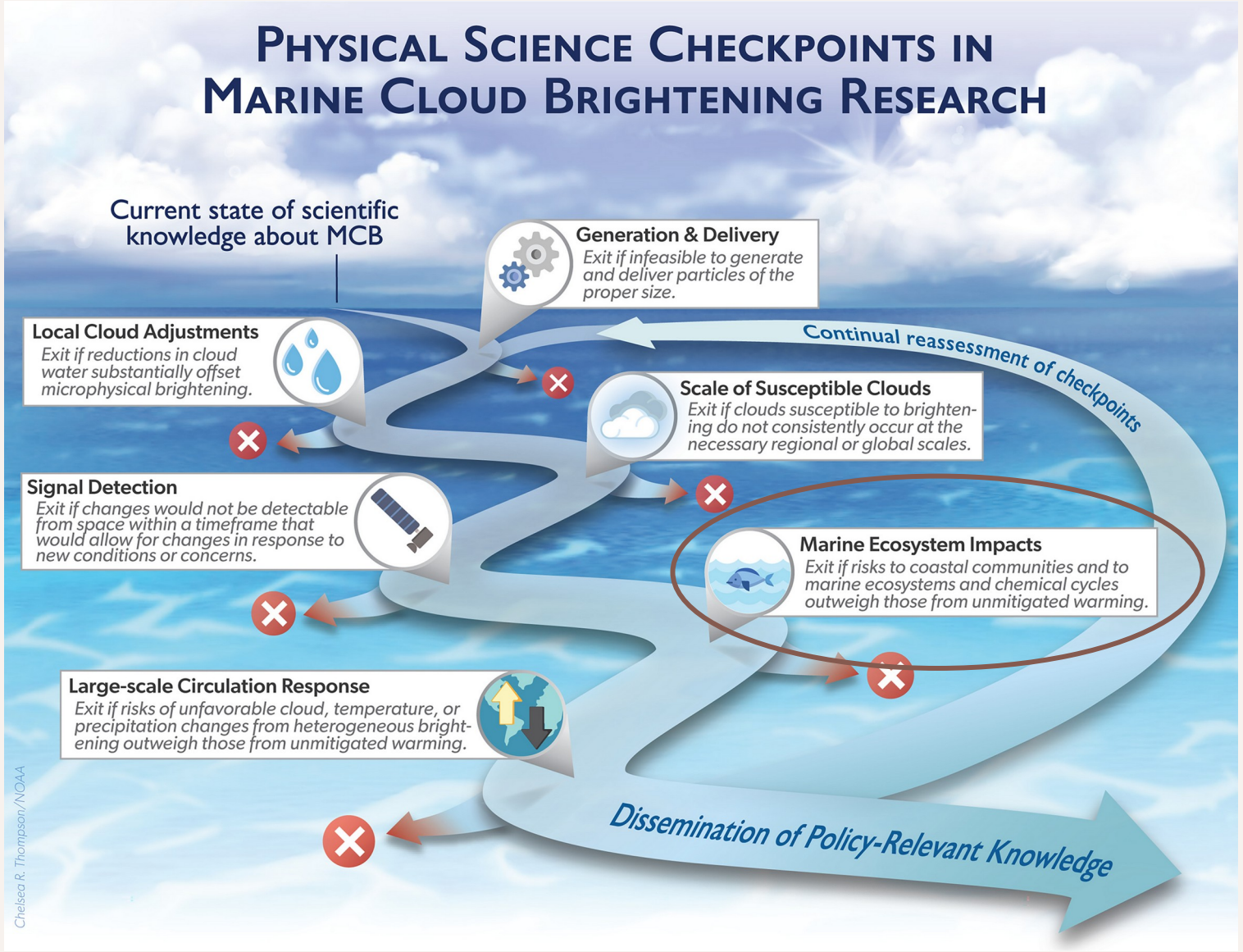
Zarnetske et al., 2021; Tilmes et al 2020

We need impact assessments

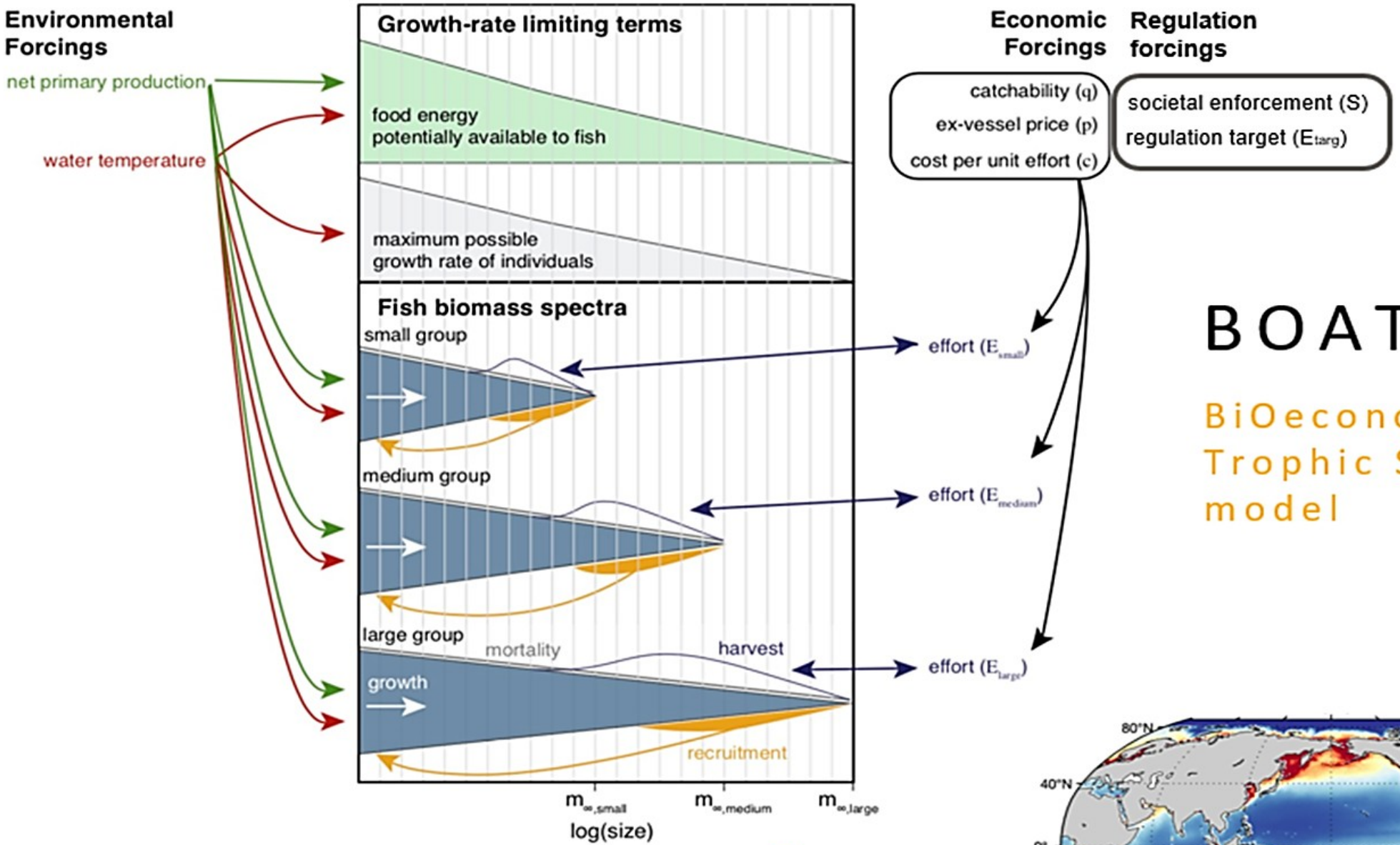


RESEARCH AIM: the potential tradeoffs of SRM on marine ecosystems must be explored to determine plausible scenarios or provide 'exit ramps' for discontinuing research & avoiding implementation

SPECIFIC OBJECTIVE: explore how changes in SST and NPP under SRM scenarios impact global fish biomass distribution

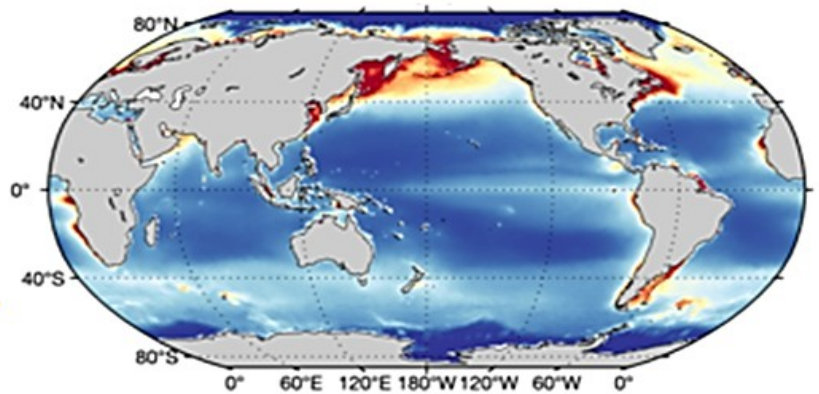


Diamond et al. 2022



BOATS

BiOeconomic mArine Trophic Size-spectrum model

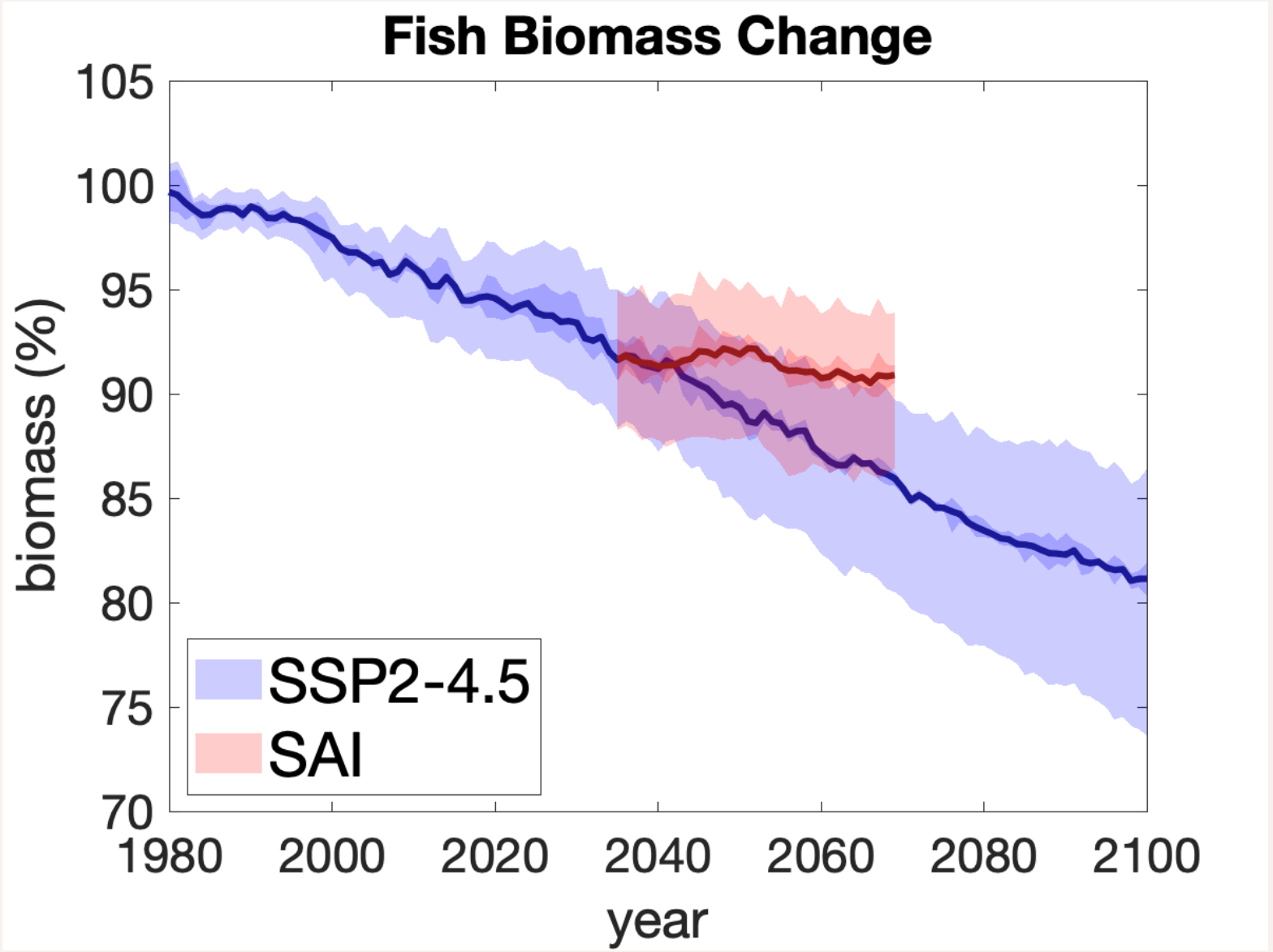


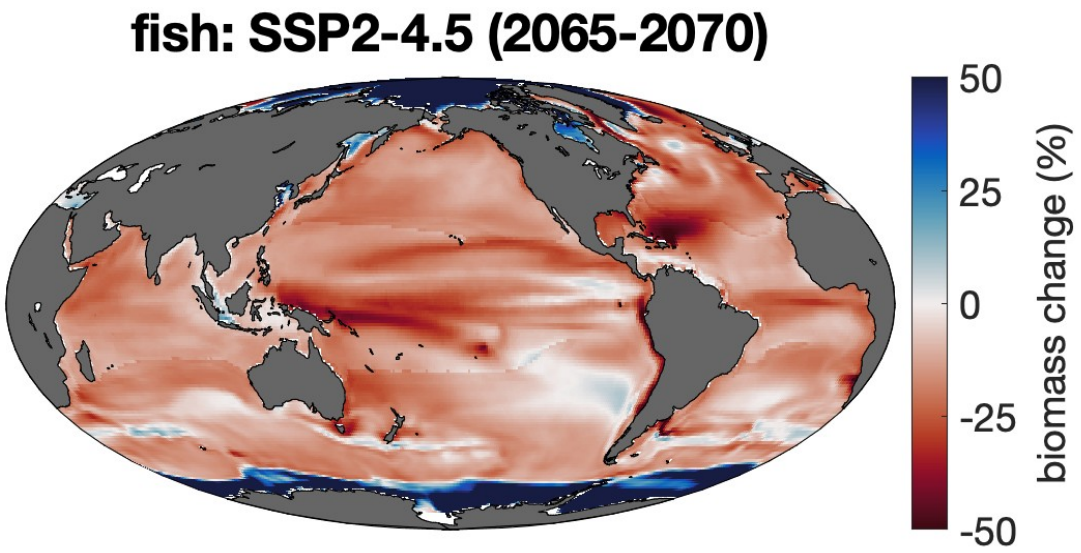
see Carozza et al. (2016; 2017) *GMD; PLOS ONE*
Scherrer and Galbraith (2020) *ICES-JMS*

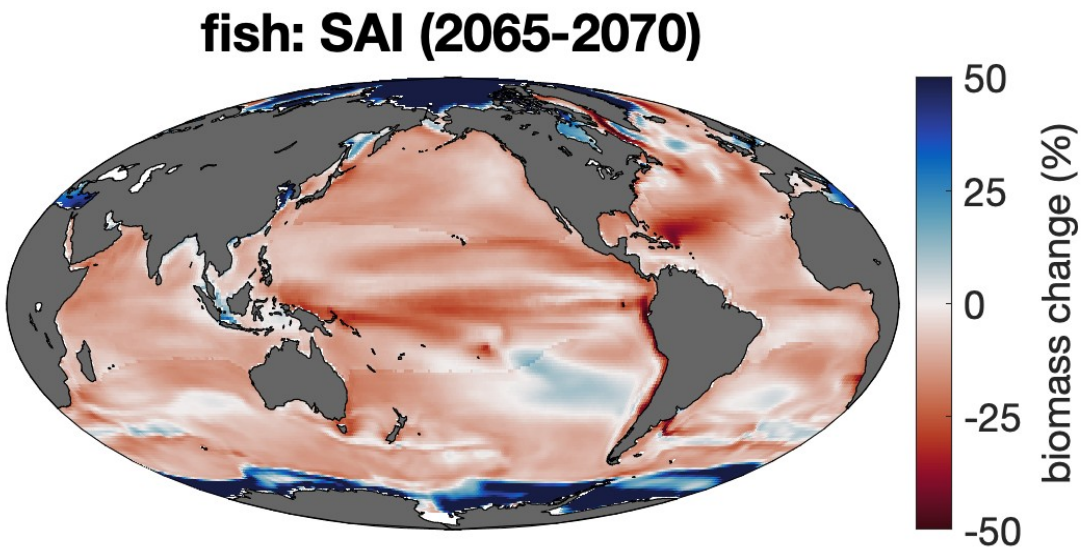
Biomass change relative to pre-industrial control

Darker shading is the climate ensemble variability

Lighter shading is the BOATS ensemble variability



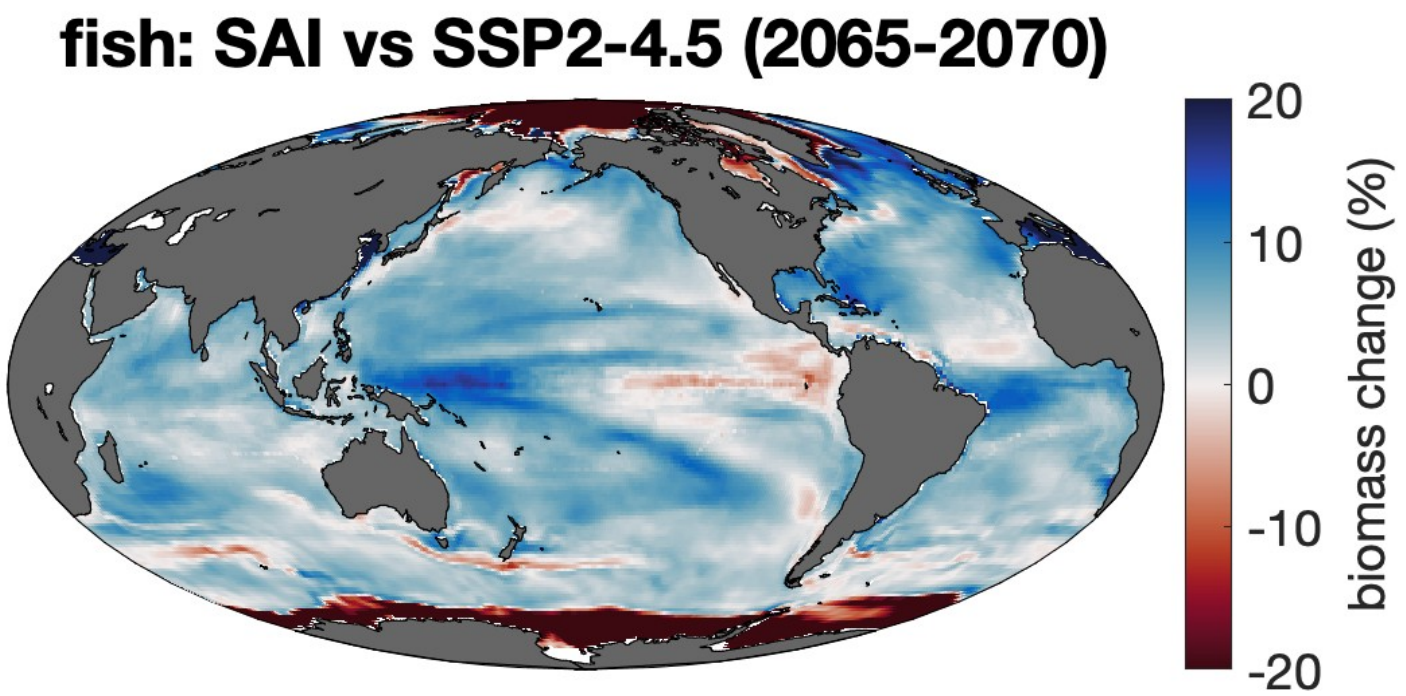




Spatial differences in biomass relative to pre-industrial control for averaged time period 2065-2070

Biomass change for SAI vs. SSP2-4.5

Up to 20% less biomass change in SAI vs. SSP2-4.5



NEXT STEPS:

1. All ensemble members for SAI

2. MCB simulations and comparison with SAI output

3. Turn on socioeconomic drivers in BOATS

4. BOATS v1 vs. v2

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