**Target journal:** Nature Climate Change

**Max length:** 3,000 words

**Max tables and figures:** 6 total

**Title (90 characters max)**

Zooplankton mediate phytoplankton decline in a warming world

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**Abstract (100-150 words)**

Global phytoplankton observed to be decreasing in body size and productivity under climate change. These negative changes are expected to be amplified by zooplankton community, resulting in a future ocean that is less efficient. We challenge this notion by exploring changes in global zooplankton community under climate change. We show that shifts in zooplankton community structure attenuate changes in phytoplankton. In particular, filter feeder zooplankton offset declines in phytoplankton size and increases in zooplankton carnivory. These bring SSP scenarios closer together – SSP585 closer to SSP126 with filter feeders and omnivores, compared to without these groups. Our results have implications…

**Main body**

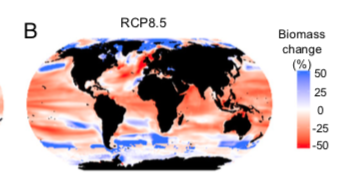
*An introduction (without heading) of up to 500 words of referenced text expands on the background to the work (some overlap with the abstract is acceptable), and is followed by a concise, focused account of the findings, ending with one or two short paragraphs of discussion. The main text should be divided by succinct topical headings of no more than 60 characters (including spaces) to aid readers.*

**Figure 1** Projected average change in biomass of fish under SSP126, SSP370, SSP585, from 1990-1999 to 2090-2099.

Part a)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SSP126** | **SSP370** | **SSP585** |
| **Global maps** | Global map of Fish | Global map of Fish | Global map of Fish |

Global maps of deltas look like this:



Deltas are constructed by dividing average biomass in 2090-2099 by average biomass in 1990-1999, averaged across four esm runs.

Part b)

Line plots of global biomass of fish under SSP126, SSP370, SSP585. Line is mean of four esm runs for each ssp, shading is min and max change for each ssp.

Chart, line chart

Description automatically generated

**Figure 2** Changes in marine food web under SSP126, SSP370, SSP585, from 1990-1999 to 2090-2099.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SSP126** | **SSP370** | **SSP585** |
| **Chord diagrams** | global integrated foodweb | global integrated foodweb | global integrated foodweb |

Chord diagrams look like this, except size of links would be dependent on of the pathway it represents, from 1990-1999 to 2090-2099. Unsure about how to represent a negative delta though…:

Diagram

Description automatically generated

**Figure 3** Impact of removing different zooplankton groups on fish biomass from 1990-1999 to 2090-2099

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SSP126** | **SSP370** | **SSP585** |
| **Global maps** | fish with no Omnivores minus fish with Omnivores | fish with no Omnivores minus fish with Omnivores | fish with no Omnivores minus fish with Omnivores |
| fish with no Carnivores minus fish with Carnivores | fish with no Carnivores minus fish with Carnivores | fish with no Carnivores minus fish with Carnivores |
| fish with no Filter Feeders minus fish with Filter Feeders | fish with no Filter Feeders minus fish with Filter Feeders | fish with no Filter Feeders minus fish with Filter Feeders |
| fish with one zoo minus fish with all groups | fish with one zoo minus fish with all groups | fish with one zoo minus fish with all groups |
| **Line plots** | Global biomass of of fish with different groups removed minus Global biomass of fish with full groups from 1990-2100 | Global biomass of of fish with different groups removed minus Global biomass of fish with full groups from 1990-2100 | Global biomass of of fish with different groups removed minus Global biomass of fish with full groups from 1990-2100 |

Global maps look similar to figure 1, except they are showing the difference between two deltas (without group delta – with group delta). Line plots have a similar concept.

**Figure 4** Comparing ‘distance’ between SSP126 and SSP585 when different groups removed

Part a)

\*\*Full\_distance: Global biomass of fish in SSP585 minus Global biomass of fish in SSP126

\*\*Group\_x\_distance: Global biomass of fish in SSP585 with group\_x removed minus Global biomass of fish in SSP126 with group\_x\_removed

|  |  |  |  |
| --- | --- | --- | --- |
|  | No omnivores | No carnivores | No filter feeders |
| **Global maps** | **Full\_distance – Omnivore\_distance** | **Full\_distance – carnivore\_distance** | **Full\_distance – filterfeeder\_distance** |

Part b) Line plots of full\_distance – group\_x\_distance. Single plot, with line for each group.

**References (50 max)**

**Methods**